

PREPARING PRE-SERVICE TEACHERS TO TEACH MATHEMATICS IN ABORIGINAL COMMUNITY SCHOOLS: A CHRISTIAN PERSPECTIVE

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The task appeared relatively simple. It was to prepare a twenty-hour course for third-year pre-service teachers, five hours of which were to be devoted to teaching mathematics to Aboriginal children living in tribal communities. This was in February and the preparation time was one week. Being unfamiliar with the topic meant extensive reading had to be undertaken in a short period of time. A course was produced after consulting the recent literature on the subject. Following the lecture series the opportunity arose to visit an Aboriginal community to observe the pre-service teachers during their field experience. From talking to experienced teachers, observing Aboriginal assistant teachers at work inside and outside the classroom, discussing lessons with pre-service teachers, and observing these communities functioning, it became obvious that the "relatively simple" task was not simple, but complex. The enormity of the task of teaching mathematics to this special group of people was a problem. It was a problem because a number of factors which had not previously been considered relevant to a methods course had emerged.

It is probably reasonable to say that pre-service programmes endeavour to give teachers survival skills to enable them to cope in their first year or two of teaching. However, the attrition rate among new graduate teachers in remote and sometimes not-so-remote communities in the Northern Territory is very high. There are various reasons why this is so. Two aspects which play an important part in the high attrition rate are a feeling of dissatisfaction and a sense of inadequacy experienced in the first year of teaching. Why does the initial enthusiasm expressed by young teachers dissipate so quickly? Christie gives us an insight into the answer:

As teachers of Aboriginal children, we assume too often that the child's view and understanding of the classroom is the same as our own. This leads us to conclude, when Aboriginal children fail to achieve in the classroom, that they are incompetent participants in the process of classroom learning. It would possibly be more appropriate to assume that the children are, from their own point of view, competently participating in the school process, but they see the nature of that process and their role in it very differently from their teachers.¹

In addition, ethnographers inform us that the socialization of teachers into an Aboriginal community takes at least twelve months. A lack of response from the children in the classroom makes teachers feel inadequate for the task and dissatisfied especially if they are unaware of the Aboriginal cultural patterns of socialization. Anglo-Australian teachers with a minimum of twenty years enculturation into Anglo-Australian society expect to overcome the cultural differences when they walk into the Aboriginal classroom. The task of teaching is a difficult one, and the task of teaching mathematics is even more difficult. The task of teaching an Anglo Australian-based mathematics curriculum in an Aboriginal setting is MOST difficult.

Relevant Factors and Features

There are a number of social, cultural, and educational factors that need to be considered when preparing pre-service teachers to teach mathematics in Aboriginal communities. A conventional methodology course is inadequate preparation to teach mathematics in these settings. In the light of wide reading, discussions with experts who have lived and taught in these communities, linguists and teacher linguists, and curriculum developers, the writers conclude that teaching mathematical concepts to Aboriginal children will never be successfully achieved unless teachers become aware of, and take into account, the mental world and educational needs of Aboriginal children. J. Harris² suggests that unless teachers are cognizant of the Aboriginal systems of knowledge it is unlikely that Aboriginal children will be successful in acquiring Western concepts and skills. The preparation of pre-service teachers to teach mathematics to Aboriginal children must, of necessity, include instruction in what Christie³ describes as "crucial distinctions between Aboriginal and white school children", as opposed to mere similarities and differences.

What crucial distinctions are relevant to the teaching of mathematics to children in Aboriginal communities? What mathematical background do Aboriginal children bring to school? Do the learning styles of Aboriginal and non-Aboriginal children differ? Are Piaget's developmental stages parallel for Aboriginal and non-Aboriginal children? Does it make a difference whether it is a bilingual or an English programme? Are there similarities with other ESL students? Although linguists, anthropologists, sociologists, and educators have been endeavouring to identify these "crucial

distinctions", some of them, in relation to the area of mathematics teaching, have been culpably ignored or misinterpreted. Only recently has work of substance been published which is helpful to the classroom teacher. J. Harris⁴ discusses some misconceptions in historical perspective and suggests that the problem is a cultural one. His remark⁵ that Stokes' work⁶ may be "the first substantial discussion on mathematical concepts of an Aboriginal group", is quite surprising, considering the extensive work carried out by linguists and anthropologists over the years.

Probably the greatest misconception relevant to the teaching of mathematics, is the belief that no Aboriginal languages have words for numbers above two or three. As recently as 1980 Dixon⁷ wrote:

The one obvious gap in Aboriginal vocabularies is the lack of any system of numbers. It is usually said that there are only numbers "one", "two", "several" and "many", some languages appear also to have "three" although this is frequently in a compound form.

This statement illustrates a widespread ignorance. While it is not possible to generalise about number systems across Aboriginal languages, some knowledge is beginning to emerge. Aboriginal languages do contain number systems, some of which are very sophisticated.⁸ There is an unpredictability about the languages. Some languages, for example, have number words that are gender-specific. One language has nine different words for the same number, the roots of the words being similar but the prefixes or suffixes quite different.⁹ This contrasts with European languages, where translations of words corresponding to numbers do not require as many parameters for translation. Clearly, Aboriginal children do bring knowledge of at least one number system to school. Our task is to build upon this knowledge base.

The difference in learning style between Aboriginal and non-Aboriginal children has been detailed by S. Harris.¹⁰ Traditionally, Aborigines relied upon an informal, non-verbal learning style. Anglo-Australian society on the other hand has relied upon a formal, verbal learning style. S. Harris discusses five features of the informal learning style of Aborigines that are particularly relevant to the teaching of mathematics:

1. Observation and imitation rather than verbal instruction;
2. Personal trial and error rather than verbal description and demonstration;
3. Real life performance rather than through practice;
4. Successive approximation rather than sequencing;
5. Persistence and repetition.

If Harris is correct, then Aboriginal children bring favoured learning styles to school. Mathematics programmes should give cognizance to these learning styles.

Aboriginal children experience a socialization process different from that

experienced by Anglo-Australian children. As babies, they are indulged by everyone and are very much a part of the social life around them. As they grow older, Aboriginal children interact with children of many ages. By three or four years of age, they may explore areas away from the immediate vicinity of home. Children have the freedom to act with, and on, their environment without the physical restraint of adults. Therefore children become physically skilled at a comparatively early age. Kearins' research¹¹ indicates that the developmental stages of Aboriginal children and non-Aboriginal children are the same. Aboriginal students, however, exhibit a superior performance on tasks requiring spatial abilities. Non-Aboriginal children perform better on tasks requiring verbal skills. These differences need to be borne in mind when interpreting Aboriginal children's performance on mathematical tasks. A maturational lag on early mathematical activities has sometimes been observed in Aboriginal children. However, care in selecting activities that are appropriate to the distinctive developmental stages of these children will promote efficient concept development.

Graham¹² states, "Classification activities are at the centre of a transition mathematics program [and] . . . the way children classify things depends on their own experiences and the way their particular culture (including language) has helped them view their world." Classification systems in Aboriginal culture reflect the activities of Aboriginal communities, whereas classification systems in Anglo-Australian culture often reflect the needs of minority groups such as the scientific community. For example, classification of animals according to movement (animals that crawl/climb/swim/fly) reflects the fishing-hunting activities of the Aboriginal community, whereas animal classification according to phyla reflects the needs of the scientific community.

Personal observation of bilingual programmes in the Northern Territory strongly supports the notion that initial literacy in the vernacular is most desirable. The Watts-Gallacher Report¹³ acknowledged that Aborigines who are literate in their mother tongue make the transition into second language learning more easily and more successfully. Graham¹⁴ suggests that all mathematics topics should be taught in the vernacular in the early grades by a fluent speaker of the language. Graham points out that instruction in English makes the task doubly difficult for the child. This is because the language used is a second language and the concepts being presented are unfamiliar. Therefore it would seem that bilingual programmes in all subjects are preferable when they are administered by those sympathetic to the principle and when they are delivered by trained personnel.

Aboriginal culture is sometimes compared to American Indian culture and some social problems are viewed as comparable. In an attempt to determine whether similar problems are experienced in mathematics education a brief review of research was undertaken which showed that American Indians are often classified as mathematically disabled. Reporting on mathematics education for American Indians, Bradley¹⁵ cited Moore¹⁶ who suggested that

the influence of American Indian culture on mathematical behaviour needs to be studied in order to understand the genesis of the problem. Bradley also discussed the need to examine American Indian learning styles. As with Aboriginal children, American Indian children use sophisticated non-verbal communication. Other researchers such as Cheek¹⁷, Tsang¹⁸, Anick, Carpenter and Smith¹⁹, and Johnson²⁰ support the notion that social and cultural factors may contribute significantly to the poor achievement of some non-English speaking groups. There are certainly similarities between the Aboriginal problems and those of other ethnic populations such as American Indians, Hispanics, and Asian Americans, and an exchange of ideas is desirable.

The issues raised in this paper thus far point to the need for educators to understand the Aborigine not only as a biological entity but as a total person. Any individual brings biological input and cultural input to the education process. A study of the New Testament gospels shows that Jesus was a master at understanding the total person and features of the teaching of Jesus are now discussed from the point of view of the issues already raised.

A Christian Perspective

Having outlined some of the relevant features of Aboriginal culture related to the learning of mathematics, one is faced with the difficulty of finding a possible reference teaching model which could be relevant for the preparation of pre-service teachers of mathematics in Aboriginal community schools. It occurred to the authors that some aspects of the parables of Jesus could provide such a reference model. The English word, "parable", comes from the Greek, "parabolē", which means a comparison or illustration, derived from a verb meaning, "to put one thing by the side of another (for comparison)".

Although Jesus used parables to teach the people spiritual truths such as the Kingdom of God, there are some aspects of the parables which could be relevant to the teaching of mathematics in Aboriginal communities and, of course, to teaching in general. These aspects include:

- (a) Jesus spoke in the common language (probably Aramaic) of the people he was addressing. This, of course, relates to the issues discussed previously regarding teaching Aboriginal children initially in the vernacular.
- (b) Jesus used illustrations drawn from the experiences of the people; as, for example, in the lost sheep²¹, the lost coin²², the mustard seed²³, the wheat and the tares²⁴, the sower and the seed²⁵, the good samaritan²⁶, the sheep and the goats²⁷, and the prodigal son.²⁸ Thus illustrations which relate to the experience of Aboriginal people and which reflect the Aboriginal learning style of observation and imitation rather than verbal instruction may be used to advantage in a community classroom.

- (c) The parable usually illustrates *one* fundamental aspect of truth. The details of the parable are significant only as they contribute to the clarification of that particular point of truth.
- (d) The parable was told in such a way that its message was *comprehensible* to the people. Bornkamm says of Jesus' parables:

they always remain within the realm of what everyman understands, what is a daily or at least a possible experience. It is just this way that things happen! That is the first reaction to each parable. It is never, as it were, a study in advanced mathematics. The parables are never equations with two or more unknowns.²⁹

A message is comprehensible when it is spoken in the native language of the listener and when any illustrations used relate to the simple cultural experiences of the people.

- (e) The parables have an individual flavour. Again Bornkamm makes a pertinent comment when he says,

Many of the metaphors and parables of Jesus begin with the disturbing question, a question which grips one right away, without any preliminaries: "Which of you . . . ? . . ." It is always a question aimed straight at the hearer himself, which neither demands from him knowledge or theoretical judgement, nor presupposes his goodness or education. The only presumption which is made in Jesus' parables is man, the hearer himself, man indeed in the plain unadorned reality of his world, which is neither put to rights according to high moral standards nor deplored with righteous indignation. Thus the hearer is gripped just where he really is, and the strongest appeal made to his understanding.³⁰

Greater initial reliance on individual or cultural strengths such as spatial ability is important if our teaching is to reflect this individual flavour and to maximise opportunities for Aboriginal children to learn mathematics.

Scripture records that Jesus taught "as one having authority and not as the scribes."³¹ His authority did not reside in some dictatorial mannerism. Instead it was derived, in part, from the simplicity, relevance and comprehensibility of his illustrations. The five aspects of Jesus' parables previously outlined contribute to this authority. Previous comments on teaching and learning in Aboriginal communities made in this paper such as teaching in the vernacular in the early grades, the use of classification activities from aboriginal experience and an understanding of the Aboriginal systems of knowledge all have common elements in principle with aspects of the parables of Jesus.

Conclusion

Much literature discusses the achievement of minority groups in mathematics but there is a paucity of research and literature relating to the preparation of teachers for these groups. There are at least two options in the pre-service preparation of mathematics teachers for Aboriginal communities. The first is the provision of units of study in the areas of education and culture that provide a depth of cross-cultural knowledge and understanding which students can draw on as they undertake their studies. Alternatively, cultural considerations can become a core component of mathematics curriculum units integrating contributions from linguists, sociologists, anthropologists, ethnographers and mathematics educators. Andersen,³² in discussing the construction of a concept of education emphasizes purposeful action in a *total* situation which includes an understanding of the physical and social environment, an understanding of other beings individually and in groups, an understanding of oneself and an understanding of the interactions between these. The preparation of mathematics teachers must help them to become aware of the total situation of Aboriginal children. They must be helped to act *purposefully*. Too often teachers are so worried about changing Aboriginal culture or of destroying Aboriginal self-identity, that they do not act at all, let alone purposefully. The parables of Jesus, in particular, may provide some foundational elements for preparing pre-service teachers to teach mathematics purposefully in Aboriginal communities.

Endnotes

1. M.J. Christie, "The Ritual Reader: Guiding Principles for Teaching Meaningful Reading to Aboriginal Children" in *Teaching Reading and Writing to Every Child*, ed. Jonathan Anderson and Kate Levett, Adelaide: Australian Reading Association, 1982, p.1.
2. John Harris, *Ethnoscience and Education in Traditional Aboriginal Communities*, unpublished M. Ed. Thesis, Brisbane: University of Queensland, 1979.
3. M.J. Christie, *loc. cit.*
4. John Harris, "Facts and Fallacies of Aboriginal Number Systems", *Language and Culture. Work Papers of SIL-AAB*, ed. S. Hargrave, Series B. vol. 8, 1982, pp.153-181.
5. *Ibid.*, p.174.
6. J. Stokes, "A Description of the Mathematical Concepts of Groote Eylandt Aborigines", in Hargrave, *op. cit.*
7. R.M.W. Dixon, *The Languages of Australia*, Cambridge: Cambridge University Press, 1980, pp.107-108.
8. J. Stokes, *op. cit.*
9. John Harris, Personal contact, 1985.
10. S. G. Harris, "Aboriginal Learning Styles and Formal Schooling". Draft Paper, Professional Service Branch, Darwin: Northern Territory Department of Education, 1984.
11. J. Kearns, "A Quotient of Awareness," *Education News*, April 1983, pp.18-22.
12. B. Graham, *Mathematics in Aboriginal Schools*, T-3 (Pt.1), Maths Unit, Professional Services Branch, Darwin, Northern Territory Department of Education, 1982.
13. B.H. Watts and J.D. Gallacher, *Report on an Investigation into the Curriculum and Teaching Methods Used in Aboriginal Schools in the Northern Territory*, Darwin: Welfare Branch, N.T.A., 1964, p.181.
14. B. Graham, *op. cit.*
15. C. Bradley, "Issues in Mathematics Education for Native Americans and Directions for Research", *Journal for Research in Mathematics Education*, vol.15, no.2, 1984, pp.96-106.

16. C.G. Moore, *The Navajo Culture and the Learning of Mathematics, Resources in Education*, vol.17, no.8, 1982, p.147.
17. H.N. Cheek, "Increasing the Participation of Native Americans in Mathematics", *Journal for Research in Mathematics Education*, vol.15, no.2, 1984, pp.107-113.
18. Tsang Sau-Lim, "The Mathematics Education of Asian Americans", *Journal for Research in Mathematics Education*, vol.15, no.2, 1984, pp.114-122.
19. C.M. Anick, T.M. Carpenter and C. Smith, "Minorities and Mathematics: Results from the National Assessment of Educational Progress", *Mathematics Teacher*, vol.74, 1981, pp.560-568.
20. W.N. Johnson, "Teaching Mathematics in a Multicultural setting: Some Considerations when Teachers and Students are of Differing Cultural Backgrounds", *Resources in Education*, vol.15, no.7, 1980, p.147.
21. Luke 15: 3-7. This and subsequent quotations, unless otherwise noted, from the New International Version.
22. Luke 15: 8-10.
23. Matthew 13: 31, 32.
24. Matthew 13: 24-30.
25. Matthew 13: 3-9.
26. Luke 10: 30-37.
27. Matthew 25: 31-46.
28. Luke 15: 11-32.
29. G. Bornkamm, *Jesus of Nazareth*, London: Hodder and Stoughton, 1979, pp.69,70.
30. *Ibid.*, p.70.
31. Matthew 7: 29 (K.J.V.).
32. W.E. Andersen, "The Teacher and the Teacher-Educator", in *Teacher Education: Towards a Radical Christian Perspective*, Sydney: Australia Teachers' Christian Fellowship, 1977.