AN ANNOTATED ABORIGINAL SCIENCE BIBLIOGRAPHY

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ABSTRACT

Science is one area within Aboriginal Education which appears to receive comparatively little attention. The author experienced this in practice when he was lecturing in science education to trainee teachers on the topic of teaching science to Aboriginal students in secondary schools. As a newcomer to the Northern Territory the author does not have direct personal experience in this area and so he decided to search the literature. No previous bibliography of this topic was found. Initially searching revealed very little, but slowly the collection of interesting articles has increased, and whilst it is realised that the selection included in this bibliography is far from complete, it is offered to the reader as a starting point.

Perhaps the area being considered needs to be defined more carefully. The initial aim of the selection was to focus upon the teaching of Western science to Aboriginal children, but this is a very narrow target and it was soon decided to broaden the field of view. The literature on adjacent topics such as articles on the methods for teaching Western knowledge to Aboriginals generally, articles about the teaching of mathematics and computers to Aboriginal students, and articles about the testing of Aboriginal intelligence are mentioned very briefly in the next section. This is because these were all considered relevant to the actual teaching of science for trainee teachers. The articles on science will be detailed in the section after next, with a brief comment on each article.

A BRIEF OVERVIEW

The Australian Institute of Aboriginal Studies has put out a very useful resource book (Barlow 1989) which lists articles and books which would constitute a sound starting point for general Aboriginal studies. Articles about schooling for Aboriginal children (Budby, 1983) and schooling in the Northern Territory (Moir-Bussy, 1983; Willis, 1985) are suggested starting points in the literature for secondary trainee teachers in the Northern Territory.

A number of articles on teaching methods to be used and the usage of language are suggested. This is where much of the research has concentrated, so there is a considerable literature, but relevant articles would include Christie and Harris (1985), Green (undated), Harris, S. (undated) Harris, S. (1984) and Kearins (1985).

It is perhaps only after reading a number of such articles that the student teacher may move on to curricular areas related to science. Northern Territory curriculum material (Harris, P., 1984a, 1984b, 1984c, 1984d) is useful. Because quantitative work in science is an essential part of Western science, an understanding of research into teaching mathematics to Aboriginal children is valuable. There are numerous articles in this area, such as those by Graham (1984), Harris, J. (1987), Malone and Taylor (1985) and Watson (1987).

Computing skills are useful in science so articles by Fleer (1987) and Fryer (1987) about teaching computer studies to Aboriginal students are also suggested. Science Education courses usually include some aspects of educational psychology, particularly on Piagetian views in conservation, so a general "culturally fair" article on intelligence testing and Piagetian studies (Ross, 1984) is suggested.

SCIENCE EDUCATION

Science education for Aboriginals has been largely avoided or downgraded. This may be because "the culture of Aboriginals is such that they do not have any interest, so to speak, in science as we know it" (Charlesworth, 1982). It is a fact, however, though many may seek to deny it, that science is a central feature of Western culture, which has given those who understand and utilise it tremendous power. Christie (1985) claims that this is a severe handicap:

> The great disadvantage of the white world-view is that it gives us more power than we know how to handle. Christie (1985)

However, there is no disagreement that this power exists, and if Aboriginal people are excluded from Western science or exclude themselves, then they can have no say in its use. A recent exemplary student essay expressed the problem this way:

> There are a number of pitfalls inherent in the difference theory. Firstly, some teachers who develop an appreciation of the differences between Aboriginal and school cultures decide that it is not appropriate for schools to intervene, because successful school learning will inevitably alter the world view of their students. The problem is, if teachers do not make Western knowledge and skills available to Aboriginal children, they effectively deny them access to participation in the dominant society, if they so choose. (Ferguson, 1990)

At the moment there appears to be a "stand off' between the Western and Aboriginal world views with few whites understanding Aboriginal science and few Aboriginals being able to appreciate Western science. This bibliography attempts to record the efforts of those who have striven to bridge this gap.

Even within the apparently narrow 'confines of a Western science approach to Aboriginal science, there still remains some doubt as to the sort of articles which should or should not be included. Generally this bibliography includes science which relates to Aboriginal education in a Western sense as well as those scientific and technological discoveries which Aboriginals have made, and utilised. Some papers relating to Aboriginal health issues are included, as are some containing information about administrative programs for improving Aboriginal access to Western science.

AN ANNOTATED BIBLIOGRAPHY - See Appendix 1.

DISCUSSION

Western education is divided for administrative convenience into primary, secondary and tertiary phases. At the primary level in the Western education system there is an increasing emphasis on overall themes rather than particular times for each curriculum area. This primary approach could fit in well in either an Aboriginal or Western setting. Various primary curricula have been suggested (Vallance and Vallance 1988; Schulter, 1986; Waunungururra, 1988; David et al. 1980; Isles, 1983) or a wide variety of other suggestions to different local circumstances.

It is at the secondary level that there is the greatest divergence of opinion on how to interest Aboriginal youth in Western science. It is also within the secondary years that Western science becomes most quantitative, most empirical and yet most abstract. Currently science within Australia introduces quantitative and abstract thought in its science curricula considerably later than other Western countries, yet it is these aspects of science that are said to appeal least to Aborigines. It is also the training in these aspects of science that produces the skilled doctors, 'scientists, agriculturalists and engineers that the country needs. There is a problem here, the solutions to which need much more research. Perhaps a way forward might be by using cognitive dissonance (conceptual conflict) (Hand, 1988) and discrepant events (Fensham, and Kass, 1988), where appropriate within teaching to trigger interest. McTaggan (1988, p.86) describes a theoretical justification for this view, but as yet there appears to be no research data to indicate any practical outcomes from such strategies.

Finally, for the reasons described above, very few Aboriginal students complete Year 12, and very few of these have chosen science related subjects. SMEC (1986) and SMEC (198,) describe ways in which they conduct bridging programs in mathematics and science to increase Aboriginal access at tertiary level in these areas.

CONCLUSION

The author offers this annotated bibliography as a starting point in the study of Aboriginal science and would be pleased to enter into correspondence with other interested parties. He would be pleased to receive other references for works on Aboriginal science/teaching Western science to Aboriginal learners.

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FLEER, M (1987) Introducing computers to schools with Aboriginals, Unicorn, 13 (2), pp 115-116.

FRYER, M. (1987). Computers and Aboriginal students, Unicorn, No.1, pp 54-55.

GRAHAM, B. (1984) Finding meaning in maths an introductory program for Aboriginal children, The Aboriginal Child at School. 12 (4) Aug/Sept. pp 24-39.

GREEN, N. (undated). The classroom teachers' influence on the academic performance of Aboriginal children, Multicultural Education: a book of readings (Partington, Garry, editor) WACAE.

HAND, B. (1988). Is Conceptual Conflict a viable teaching strategy? The students view point, The Australian Science Teachers Journal (November) Vol. 3, No.4, pp 23-28.

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HARRIS, P. (1984c) Teaching about money in tribal Aboriginal communities. (Mathematics in Aboriginal Schools Project 2), Northern Territory Department of Education.

HARRIS, P. (1984d). Teaching the space strand in tribal Aboriginal schools. (Mathematics in Aboriginal Schools Project 2), Northern Territory Department of Education.

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HARRIS, S. (undated) Traditional Aboriginal education strategies and their possible place, in a modern bicultural school, Multicultural Education: a book of readings, (Partington, Garry, editor), WACAE, WA.

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Footnote

The author would like to thank Dr Stephen Harris for help and encouragement in writing this paper but the final responsibility for opinions and comments remains that of the author.

Appendix 1. An Annotated Bibliography

Anon (1989) "Interactive Science in 'the Outback" Gems. (Gender Equity in Maths and Science) Vol. 1 No.5. pp 8 - 10. This article recounts the experiences of some of the explainers of the Shell Questacon Science Circus in rural Australia.

BINDON, P R (1988) "Science in Aboriginal Australia". Australian Science Teachers Journal, July, 34 (2), pp 16-21. Peter Bindon who is an archaeologist with the Western Australian Museum explains the various technical achievements of the Aboriginal peoples of Australia, not least the dissemination of these breakthroughs over such a vast continent. The article examines the current views about these technologies but does not include list of references.

BURFITT, H. (1988) "Science and Technology in Australian Studies", Curriculum Australia, Issue 6, March, pp 12-15. A brief article on Australian Studies which includes a section on Aboriginal Science and Technology.

DAVIS, S. et al (1979) "Natural science - natural approach and indigenous content in Aboriginal schools", Developing Education 7 (3) October, pp 20-24.Steven Davis, Ian Morris and Bruce Sommer advise the new science teacher to use a natural approach and indigenous content to teach science. They also argue strongly that science was traditionally the core of Aboriginal learning and give a number of case studies to illustrate their point of view.

DAVIS, S. et al (1980) "Community based science programmes for Aboriginal schools", Developing Education, 7, pp2-1O. Steven Davis, John Harris and Stuart Traynor believe that any program of science education for Aboriginal schools should be community based and they explain how to achieve this in practice. They compare the learning strategies of Aboriginal and European children and- examine the skills needed to understand Aboriginal and western science, concluding that one possible curriculum framework would be the local seasonal calendar.

DOLMAN, S.E, (1984) "Aboriginal women and girls in a technological society", Women in Education Conference, Perth, W A, Education Department, Equal Opportunities Branch, pp 53-58. A paper that is strong in rhetoric, but unfortunately lacking coherence. The recommendations concern access to computers for Aboriginal people.

GANAMBNARR, M. (1982)."Thinking about writing an Aboriginal science curriculum", The Aboriginal Child at School, 10(5) Oct/Nov, pp 38-43. Munymuny Ganambarr, who was a teacher's aide at Millingimbi school, emphasises the value of community involvement in science education. The paper also stresses the value of children talking, with the teacher listening, to ensure that understanding has been achieved.

HANSEN, M.J. (1977) "The Boomerang", School Science Review Vo1.58 No. 204, March pp. 428-437. An interesting article on making and using boomerangs and on the physics of their flight. The author appears to admire the sophistication of the flying machine, but has little flattering to say about the inventors.

HANSEN, M. (1989) "The Flight of the Boomerang" Physics Education, Vol. 24 No.5, September, pp 268-272. Further information on the boomerang by the same author who now appears to give some credit to the original inventors.

HARRIS, J.W. (1978) "Aboriginal science, western science and conceptual interference", Australian Science Teachers Journal, pp 61-87. John Harris looks at linguistic problems in the misunderstandings in science and also at conceptual interference. His main emphasis is on giving equal respect to Aboriginal and western science when teaching Aboriginals.

HARRIS, J.W. (1979) Ethno-science and its relevance for education in traditional Aboriginal communities, M. Sc. thesis, University of Queensland (unpublished), (available in NTU library). John Harris's Masters thesis contains much of the evidence on which he based the views expressed in his A.S.T.J. article.

HASTIE, R.M. & TREAGUST, D. F. (1985) "Helping Aboriginal students to understand science and mathematics concepts", The Aboriginal Child in School, 13, (4), pp 8-15. Ross Hastie and David Treagust explain how standard Piagetian conservation tasks were modified for Aboriginal primary school students in Western Australia. The general advice given would be useful for anyone carrying out research into science or mathematics linked projects with Aboriginal children.

HEATH, L.R. & JONES, R. (1988) "Aboriginal conceptions of the working of nature", Australian Science in the Making (editors R.W. Home, Cambridge University Press, Cambridge- pp 1-22. The first part of this paper gives a brief description of how Aboriginal peoples have used the natural world in ways that could be termed as scientific in a European context. The second part the paper describes the

Aboriginal conceptualisation of nature which makes no distinction between religious philosophy and science.

MAIDEN, A.N. (1989) "AIDS, the sad, mad untold stories", The Independent Monthly. July, pp. 35-37. This piece is said to be the first comprehensive account of how AIDS threatens the Aboriginal race. A journalistic account based on interviews and hearsay but pointing out a real risk.

NEEDHAM, B. (1988) "Traditional Aboriginal Australian and Secondary Science 7-10, Science & Mathematics Education Newsletter, Vol. 10, No 1; P 11 & p. 24. A brief article which illustrates how various aspects of traditional Aboriginal life could be incorporated into the teaching of various scientific concepts in western schools.

NORTHERN TERRITORY DEPARTMENT OF EDUCATION. (N.T.D.E,). Bridging Course in Science Concepts, (Volumes 0-7). A very good set of curriculum materials to help those struggling with elementary scientific principles at the start of secondary courses. It is written for any pupils experiencing difficulty in their first year of secondary school, not specifically for Aboriginal pupils.

NORTHERN TERRITORY DEPARTMENT OF EDUCATION, (undated) Environmental science for Aboriginal schools. (Early Childhood). Professional Services Branch, Northern Territory Department of Education. This is an attractively presented publication designed for use by Aboriginal teachers working in teams with non-Aboriginal teachers with early childhood Aboriginal children.

RITCHIE, S.M. (1987). Improving the learning environment for Aboriginal students in science classrooms, Research in Science Education, 17, pp. 23-30. Steve Ritchie's paper describes an alternative program of science instructions using the N.T.D.E. bridging course described above as its basis. The participants were described as poor readers, but many of the poor readers were also Aboriginal. Ritchie concluded that

> The implementation of the program at the study school significantly improved their level of perceived satisfaction amongst the Aboriginal program participants. (Ritchie, 1987)

SCOTT, A (1986), "Material culture in traditional Aboriginal society: fact & fiction, Australian Science Teacher's Journal. 32, pp 9-18.

Sandy Scott's very thorough paper provides "the interested teacher with a useful set of references, but more specifically puts to rest Some misconceptions held by Europeans generally about the traditional Aboriginal technological achievements.

SCOTT, F (1989) "Dreamtime technology", Gems, (Gender Equity in Maths and Science) 1 (5), 15-22. This article by Fiona Scott briefly describes how to carry out demonstrations on boomerangs, ochres, spears and Woomeras, and bullroarers, Additionally she provides useful additional references and addresses.

SMEC (1986), Aboriginal Bridging Programmes in Mathematics & Chemistry, Progress report to Commonwealth Tertiary Education Commission, Science & Mathematics Education Centre, WAIT, W.A.

This document provides details of ways in which one university is trying to increase access by Aboriginal science and mathematics students to its degree programmes.

SMEC (1987) Aboriginal Bridging Programme in Mathematics and Chemistry, Third and final report to the Commonwealth Tertiary Education committee. Science and Mathematics Education Centre, Curtin University of Technology, W A. This updated booklet provides much more detailed information about the SMEC Bridging projects. Although numbers of participating students appear to be low and unit costs high the future of this worthwhile project appears to be assured.

STACY, S. (1983) "Aboriginal nutrition", The Best of the Science Show. (editor Robyn Williams). Thomas Nelson, Melbourne, Victoria, pp 135-141.

Sandra Stacy's short article effectively presents the problems of Aboriginal health and education which may be illustrated by a quotation "People like me know that sickness in Aboriginal children is related to nutrition. The Aboriginals know it is not". This gap in perceptions is illustrative of the different world views.

TAYLOR, P., MALONE, J.A. & TREAGUST, D.F. (1988). "Case studies of Aboriginal students -a measure of success for tertiary studies". The Aboriginal Child .at School 17 (1), 8-24.

This article indicates some of the problems which Aboriginal students enrolled in the science bridging courses (5MEC 1986) may experience.

TRAYNOR. S. (1990) "A Technological Breakthrough". STANT Newsletter. (Science Teachers Association of the Northern Territory) February. A very short piece about how Aboriginal peoples extract the resin from grass (Gummy Spinifex) and use it as an adhesive.

WHITE (1986) "Substance Abuse: Causal Factors and Treatment" Aboriginal Child..at School Vol. 14. No.3. pp 3-12. A valuable article which emphasises the need to educate the public in general and children in particular about the various forms of substance abuse.

YUNUPINGU. GALARRWIJY (1988), "What Aboriginal Land Ownership means for intending miners". Mining Petroleum and Supplies Conference. Darwin. Northern Territory, May 10-13. A piece of polemic rather than an argued case, but indicating how strongly Aboriginal people feel about mining.

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