The Australian Journal of
INDIGENOUS EDUCATION

EDUCATION BY PRODUCTION

* *Robert Laird*

Every curriculum area requires careful and particular thought when being taught to Aboriginal students: it is teaching one cultural context to another culture which is not familiar with it. This paper will deal with a remote Aboriginal community, as familiarity with the mainstream culture is less and the disparity between the cultures is greater. The specific programme will apply to a combined year five and six. The curriculum area to be examined will be science as it has been comparatively neglected in the past (Palmer 1990;34). It must be made explicit that the following is 'western' science and that it is no better or worse a system of looking at the world than any other - just a different one.

In traditional Aboriginal societies, Davis claims, "Knowledge was stabilised as much as it had ever been in any human society."(Davis 1980: l) This is misleading as there were many social and technological changes during the 60,000 years of peaceful habitation of 'Australia'. It is said that the boomerang developed 10 -12,000 years ago (Bindon 1988:20) and in between the Aboriginal people of Australia developed at least three methods of starting fire and discovered several types of tree to carry it around (17). Fire was used by Aborigines as more than a land management tool: to soften wooden staves and temper brittle stone; to oxidise pigments and dispose of the dead as well as for heating and cooking. (18) All of these may be seen as Aboriginal science but that way lies danger. All of the developments outlined by Bindon were probably the result of trial and error and negotiation, and have many meanings other than their physical. In other words it is embedded in Aboriginal culture and these 'achievements' would only be seen as scientific by a Westernised person to whom a certain portion of the world and its developments are scientific. It has been claimed that "the culture of Australian Aborigines is such that they do not have any interest, so to speak, in science as we know it." (Charlesworth 1982:18)

---

* Robert Laird,was teaching at Barunga Community Education Centre, Northern Territory when this article was submitted.

While there were many technical developments in traditional Aboriginal society they are not really in the same boat as western science. The changes in technology in Australia are not of the same tradition as Galileo, Copernicus, Bacon, Popper and so on. In this way Charlesworth (18) is correct. This is why it is dangerous to begin to talk of an Aboriginal science (Christie, Davis and Harris, J. *et al*) for it is imposing a western ontology on an Aboriginal one. If we consider it more in terms of domains of a two way school (Harris 1990b) then any Aboriginal technology and its usage belongs in the Aboriginal domain. If, for example, the physics of the boomerang were examined in the western domain then it would not be conceptual interference but cultural interference.

Western science and technology is relevant, however, to the lifestyles of Aboriginal people even in remote communities. The invasion of "tins, Toyotas and telephones" is very widespread. Aboriginal people want to use and possibly fix these things, though in such communities they do not want to produce them. Some understanding of western science is obligatory for the effective use and repair of these western imports. Further, the children on such communities are promised (by governments) an adequate education to prepare them for mainstream secondary school studies, and for a possible life in the westernised cities and towns of Australia. An understanding of scientific concepts is crucial for this.

While equal respect needs to be given to both ontological systems, part of making the implicit explicit is to avoid interference between conceptual systems. This is a central tenet of the two way model. Therefore using local resources and familiar language is to be encouraged. The research shows that:

> *any science and mathematics taught must contain aspects with familiarity of material and of language if the subject matter taught is not to be seen as trickery or Aboriginal students are not considered poor learners. (Hastie - Treagust 1985:8)*

While Hastie and Treagust were referring to assessment tasks, the same is true in all learning tasks and introduces the importance of methodology. In other words, Aboriginal children need adaptions in both curriculum and pedagogy to be able to interact confidently with western science concepts.

It is important to select the most appropriate sections of the curriculum to teach to remote Aboriginal students. At least as important, possibly more so, is the methodology. The teaching of Aboriginal students by a non-Aboriginal requires an approach that takes more into account than merely being cross-cultural. Explicitness is necessary also about methodology. Adaptions need to be made to content and process. In this paper, a programme based on a vegetable garden will be described to show how these ideas can be applied in practice.

In order to avoid both conceptual and cultural interference, the type of science to be taught needs to be clear. Teaching western science, or the Education Department's curriculum, belongs in the western domain of an Aboriginal two way school. Whether the school is officially or even consciously two way does not really matter as the two way model can be seen as an heuristic device. The western domain still exists where a non- Aboriginal teacher is trying to teach western ideas. Then "the implicit needs to be made explicit" (Harris 1990a:14) . The whole cultural context behind a concept needs to be made explicit. The best way for this to happen is for it to be displayed. The science program in this paper is based around a vegetable garden, and while not leaping as far beyond traditional Aboriginal technology as Altman's drum of flour, it is a giant step in the mode of production. The cultivation of plants and its concomitant processes is what differentiates a hunter-gatherer society from an agrarian one. Economically speaking it also deals with the extent of specialisation in division of labour, a division which exists to some extent in all societies, except perhaps the fabled Robinson Crusoe.

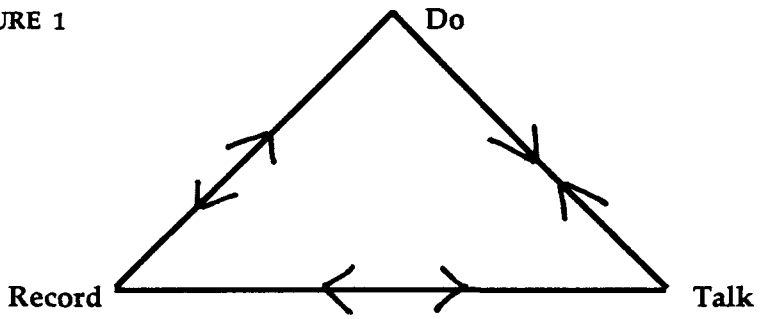
The effect of agrarian cultivation and other western technology deserves longer treatment as there are inevitably spin-offs. Such ideas are not, however, in the scope of this paper except to note the inevitable danger of "losing oneself" (Harris, 1988) when exposed to new systems of thought. To guard against this, any such programme needs to be firmly embedded in a supportive two way school.

It is essential to be explicit about methodology. Too often novice teachers are sent to Aboriginal communities. Much more preparation should be done by the Department of Education so that the new teacher has some strategies that s/he can employ, and some understandings to assist the development of their own style of teaching.

These specific teaching methodologies have been much discussed by Aboriginal educators in the last fifteen years. Harris (1990a) outlines eight tools which are needed to teach western concepts in a two way school which are worth summarising them.

First, the use of the teaching triangle,(see figure one) where children and teacher have an educational experience. To discuss it all the while, and then making a record of it is essential.

FIGURE 1



Second, teachers should be aware of Aboriginal learning styles and their strengths and weaknesses. The strengths can be utilised with the lap method, the shared book experience and groups negotiated texts.

Third, it is imperative that learners are aware of the background or cultural and situational context so that predictions can be made .

Fourth, a sound theory of second language learning is vital, along with methods such as concentrated language encounters.

Fifth, academically purposeful learning should be taking place in the classroom. Here, Harris contrasts purposeful learning with ritual (10).

Sixth, the use of curriculum genres which promote students' cognitive work, or interaction patterns, is encouraged. The use of small groups for learning and engaging in interesting activities is supported in most modern educational contexts. It is most appropriate for Aboriginal students as it encourages them to talk in the classroom.

Seventh, Harris suggests that teachers should be warm and demanding. (14) Although this may appear an unwritten prerequisite for the teaching profession, it needs to be made explicit. Often teachers' expectations of students in Aboriginal schools drop when faced with irregular attendance, poor punctuality and so on. This is to be consciously avoided, as when expectations fall, performance is concomitant.

Lastly, Harris reminds potential teachers to control the hidden agenda by constantly being aware that they are to learn as well as teach and be explicit about cultural differences rather than superiority. All this is necessary for empowerment in the western world, or the option to be so empowered. (Harris 1990b:130)

Working from the known to the unknown is an important educational principle, so if the science section of the curriculum is going to be effective then it needs to build on existing knowledge. (N.T. Dept.of Education 1986:4) As western science is based in many ways on systems of classification it would be an important component of any science programme to have a 'nature walk' once a semester. During the walk, one particular western classification (such as bird, bat, rocks, or trees) would be spotted. Different ways of classifying it would be discussed. There would be at least one local method of classifying or seeing, and also the western one. These could be compared in chart form back in the classroom. (NT Department of Education undated:30-2) This would provide a firm foundation for making western science explicit, for after all, it is a way of seeing and thinking. Cultural and conceptual interference can be avoided by making explicit those implicit differences between western and Aboriginal ways of seeing and thinking.

The use of a vegetable garden project makes the teaching context explicit. It also locates the exercise clearly in the cultural context, which will assist the students in learning. (Harris 1990a: 15-17) It is not only scientific lessons that can be conducted in a vegetable garden, nor even the discipline of maths, or for that matter language: above all, it provides the opportunity to be able to teach thinking. Picture, if you will, a walled garden with vegetables below and above ground grown in irrigated beds. More description can wait, but ponder the cultural creation already:

an irrigated, fertilised plot of soil, already so far from traditional Aboriginal culture, with a wall around it, no less - carefully delineating the limits of culture (and keeping the dogs out!) - strategically cultivating plants for future use. This is most emphatically not to say that western science is better than Aboriginal methods of classification, food gathering and so on. Such a project does, however, provide physical, visual reinforcement of the great differences between the cultures.

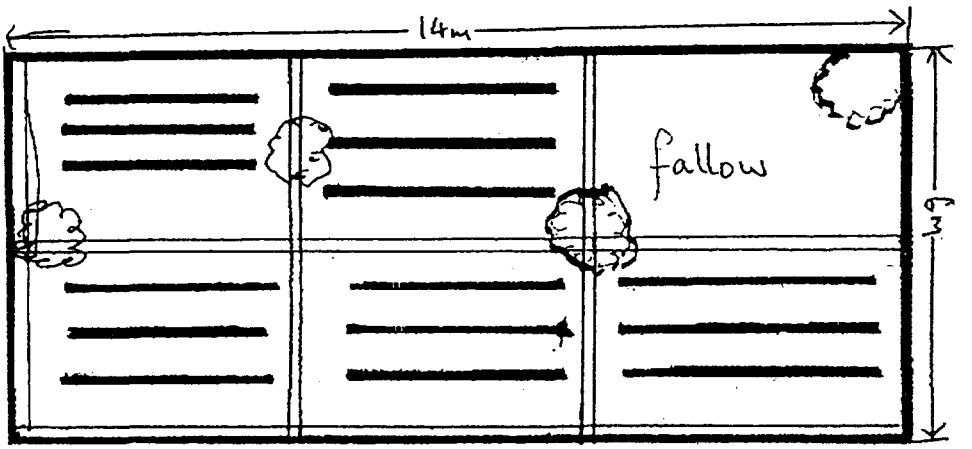
In dealing with the Northern Territory science core curriculum it is worth noting that it is currently under review. Listed under the years five and six overviews are some thirty-seven investigations. The author is not attempting to ' fit in' all of those investigations. Rather the drive of this paper suggests that teaching science to Aboriginal students demands that a context is created in the western domain of a two way school and that as much as possible the learning should proceed from the known to the unknown. The project being described could be called Education by Production: a school vegetable garden. The programme will address the core skills laid down by the Education Department, for it is these skills which the Department wants students to obtain by the end of primary schooling, not necessarily a check-list of completed investigations. These suggested investigations to be undertaken only exist so that skills and ideas may be developed. Further, the concepts that children are to learn should be seen for what they are: currently accepted wisdom, which is both culturally and temporally relative. Scientific concepts change, adapt, grow, are proved wrong, all in relation to culture and society. Science teachers in mainstream western schools would do well to impress this on all students.

After a description of Education by Production, it will be explained how gardening will develop those core skills decreed by the Education Department.

Assuming that the Education by Production project could receive funding from somewhere, then it would be worthwhile involving groups of students in the construction of the fence, the installation of the irrigation system and the removal of existing plants. A rectangular shape of six metres wide and fourteen metres long would allow enough space for paths, communal fruit trees, a tool shed, and six plots of about ten square metres. Each plot could contain three garden beds about three metres long.

If the class contained thirty students, then each of five small groups (small to promote learning) would have six members. There would be enough plots for each group to have one, and there would be one plot remaining fallow so that a composting program could save our ecological future (see Christie). Inside each plot would be three beds, about three metres long. Each group could decide whether to work the plot as a whole, or work each bed in pairs. There is a map of the garden included in figure 2.

FIGURE 2



The main skills that the Department wants all children to develop in science are inferring, measuring, communicating, observing, using time/space relationships and classifying. All of these skills could be developed by children setting up the garden infrastructure. Then these skills, and others as well, can continue to develop for the life of the garden. There are lengths and widths to measure and heights and depths too. The progress of a plant can be measured in space and plotted against the time that it takes. At the commencement of Education by Production it would be sound to examine with the class the needs of plants and do experiments testing the hypotheses that they need water, light, air and soil. These principal understandings established early on could lead to greater depths of understanding: what makes soil necessary? How can it be made better? One pair or group, who have been encouraged to watch closely, could communicate to other students the structure of plants and how they reproduce. It is clear that climate affects plants - measurements can be kept and charts made. The plants could be classified by formal family type or how they are used,

or even their colour. The list of activities for a variety of age groups is almost endless and could easily run a two year period of four seasons. The rewards of Education by Production would also be more practical in terms of fruit and vegetable for health education, and the development of specific skills and knowledge that could be applied to outside employment, or a larger community-based project.

Praxis.

The garden set up during 1991, at Barunga was funded through Commonwealth Programmes' Country Areas Programme. It was found that one classroom teacher could not exhaust the potential teaching scenarios contained in the vegetable garden. By working in small groups the children were utilising problem solving approaches to installing the irrigation system, forming the garden beds and deciding what to do with perennial plants over the wet season, amongst other situations. The garden as a whole was regarded with a sense of pride and the rivalry between the tenders of different beds was healthy. During 1992, new shelving will be utilized to grow seedlings both for growing in the beds and to send small plants to be tended at home.

Conclusion

The Education by Production programme is providing its own concrete material for lessons in the western domain of a two way school. It can be used by teachers as the basis for lessons, not only in science but in maths, health, the arts, and of course language. It provides a real context for these lessons. By moving from the familiar to the unknown, children are building the skills deemed appropriate by the Education Department and, more importantly, being introduced to critical ideas and skills from the western scientific and technological universe which will make them better able to operate in western society if they so choose.

BIBLIOGRAPHY

Altman, J,C., (1987) *Hunter-Gatherers Today; An Aboriginal Economy in Northern Australia*, Austalian Institute of Aboriginal Studies, Canberra.

Bindon, P., (1988) "Science in Aboriginal Australia," *Science Teacher's Journal*, Vol 34 No. 2, pp 16 - 21.

Charlesworth,M., (1982) *Science, Non-Science and Pseudo-Science*, Deakin University Press, Geelong.

Christie, M,J., (1990) Aboriginal science for the ecologically sustainable future, submitted to Ngoonjook.

Ganambarr, (1982) 'Thinking about writing an Aboriginal science curriculum" *The Aboriginal Child at School*, vol. 10, no. 5, pp 38 - 43.

Harris, J., (1978) "Aboriginal science/ western science and conceptual interference," *Australian Science Teacher's Journal*, vol. 24, pp 61- 67.

Harris, S., (1988) "'Coming up level' without 'losing themselves': the dilemma of formal tertiary training for Aborigines" in Harvey,B. and McGinty,S.,*Learning My Way*, Western Australian College of Advanced Education, Mt Lawley.

Harris, S., (1990a) *Teaching Methodolgy for the Western Domain of an Aboriginal Two Way School*, unpublished manuscript, NTU Darwin.

Harris, 5., (1990b) *Two Way Aboriginal Schooling: Education and Cultural Survival*, Aboriginal Studies Press, Canberra.

Hastie, R.M., & Treagust, D. F., (1985) "Helping Aboriginal students to understand science and mathematics concepts, *The Aboriginal Child at School*, 13 (4).

Northern Territory Department of Education (1986) *Social and Cultural Education Guidelines for Aboriginal Schools* T - 7, Darwin.

Northern Territory Department of Education, (1988a) *Science for Primary Schools Years T - 7, Core Curriculum*, Darwin.

Northern Territory Department of Education (1988b) *Science: Depth of Understanding and Skill Development*.

Northern Territory Department of Education, (undated) *Aboriginal Science Teacher's Handbook;* Incorporating the Milinigimbi Case Study.

Palmer, W.(1990) "An annotated Aboriginal science bibliography," *The Aboriginal Child at School*, 18 (5) pp 34 - 43.

Ritchie, 5., (1987) "Improving the learning environment for Aboriginal students in science classrooms," *Research in Science Education*, vol. 17, pp 23 - 29.