Aboriginal and Islander Mathematics: Comments on one aspect of the proposed National Curriculum

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The draft [1] of the recently announced National Curriculum for Years K–10 contains the following passage.

> Intercultural understanding can be enhanced if students are exposed to other cultures' view of mathematics, for example, through examining Aboriginal and Torres Strait Islander peoples' perceptions of time and weather patterns, the networks embedded in family relationships and the algebraic concepts inherent in storytelling.

A little later, we find:

> Cross-curriculum dimensions are not explicitly tagged in the content descriptions.

> Aboriginal and Torres Strait Islander dimensions are included in the elaborations. It is imperative that all Australian students learn from the wisdom of the first Australians. For example, when considering the idea of seasons in measurement and geometry, the European tradition of four seasons can be compared and contrasted with the different constructs used by Aboriginal and Torres Strait Islander people in different parts of the country.

> The idea of using symbols as a way of generalising relationships can be enhanced by drawing on the perspectives of Indigenous Australians.

This means that detailed syllabuses are not provided, but that suggestions will follow. However, I will argue here that these passages envisage the introduction into the National Mathematics Curriculum of a topic (Indigenous Mathematics) which, strictly speaking, does not exist. It is no derogation of Aboriginal or Islander culture to recognise this fact. Indigenous Australians did not build Gothic cathedrals either. We all know this and no-one thinks any the worse of them on this account. Attempts to discover an Indigenous Mathematics are undoubtedly well-intentioned, but ultimately ill-directed. It is neither useful nor beneficent to bestow on aspects of Aboriginal and Islander cultures a significance that they do not, in fact, possess.

The inclusion of Indigenous Mathematics in the National Curriculum raises the obvious question of quite what mathematics could be taught in such a context. Despite the claims of a few enthusiasts (to be detailed and discussed below), there is really *no* indigenous tradition of mathematics, properly so-called, in this country.

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When Graeme Cohen was writing his history of mathematics in Australia [5], he and I had some correspondence on precisely this issue, and eventually Cohen, who was keen to detail as much as he could in this area, settled on the three paragraphs that span his pp. 19–20. Here he is concerned to note that some earlier accounts of Aboriginal numeration (such as [2], [6]) were oversimplified and indeed incorrect. He lists among 'other concepts that may be described as mathematical', familial relationships and some temporal, physical and geometric notions. Even so, his passage concludes: 'There were no written languages, however, and probably for that reason there was no systematic development of mathematics'. There is reference in the relevant endnotes (1–5 of Chapter 1) to six further studies that may perhaps not be the best he could have chosen, but are nonetheless typical of writing in this area. Specifically, he lists:

- a brief popular book by Rudder [17],
- a paper by Harris [9] (who has also written further on this topic elsewhere [10]),
- an early account of kinship systems [13],
- a more recent discussion of kinship systems [7],
- a technical paper relating to Groote Eylandt [19], and
- a discussion mainly concerned with the teaching of mathematics to Indigenous Australians [21].

He evidently chose not to make reference to further papers (including [10]) in the collections [8], [18] in which much of this work appeared.

When we speak of a *national* curriculum, we necessarily refer to those elements of learning that are to be presented to *all* students, in other words, core material. This, of course, does not and should not preclude the use of more specific material that may be apt in some particular classroom context. Thus, the introduction of specialist material when the class comprises a large proportion of Indigenous Australians, or even of other pupils who regularly interact with them, is quite appropriate, and this, I take it, is what Wood [21] is saying. But this is a far cry from making it part of the overall National Curriculum.

What most of the authors listed above do is to highlight aspects of Aboriginal or Islander lore that either have, or else can be given, a mathematical 'flavour': what we might term 'proto-mathematics' rather than mathematics proper. The point is even conceded explicitly by Rudder [17], whose overall stance is most sympathetic to Aboriginal culture and who shows a very great respect for it throughout. But still he has this to say: 'They do it [classification] almost completely without numbers' (his p. 5, and cf. his p. 40). And on one attempt to translate Aboriginal proto-numerals into precise arithmetic terms: 'This was a good try, but it really shows that relationship mathematics and number mathematics don't have the same meaning'. (The example is based on 'turtle egg mathematics' and seeks to identify the number 20 with an expression whose literal meaning is "3 'rulu' and a 'rulu' that doesn't matter". This can hardly stand as a precise translation of the number twenty; moreover the expression is clumsy in the extreme.) In other words, these concepts are not precise enough to lend themselves even to the simplest arithmetic manipulation; they are *not* mathematics.

Rudder also briefly adverts to notions of time in the sense of both calendric time and time of day. Again, such material is mathematical in only the very broadest sense of that word.

Harris [9], [10] is concerned to rebut some rather denigratory statements made by earlier linguists like Blake [2] and Dixon [6] on the questions of Aboriginal numeral systems. His work is thus a welcome and indeed much-needed correction of earlier erroneous pronouncements. The papers by Geytenbeek [7] and Stokes [19] may be placed in this same context. Nonetheless the existence of a coherent system of numerals can hardly be said to constitute mathematics (except again in the most basic of senses), even in the (rare) cases adduced where the system is highly elaborated.

When we come to 'the networks embedded in family relationships and the algebraic concepts inherent in storytelling', we are on rather uncertain ground. It is true that a structuralist tradition deriving from the anthropological work of Lévi-Strauss has analysed kinship rules (incest taboos) in group-theoretical terms. The best account I know of this material is provided by my colleague Hans Lausch in the school mathematics journal *Function* [12]. Many, perhaps even most, other expositions are plain wrong, including the oft-cited one in the text *Finite Mathematics* [11] by Kemeny, Snell and Thompson. Error in another account has been pointed out in a recent review [16]. However, Lausch [12], Cargal [3], [4], and Pekonen [16] all provide accurate accounts of the mathematics that has been used to analyse the kinship rules. Even so, doubt has been expressed [3], [4] over how well the mathematics captures the underlying ethnology. Furthermore, Mathews [13] lists various exceptions to the underlying rules and, although his account predates the mathematical analysis, it may be read as implicitly concurring with such doubts.

Although Lausch's exposition [12] was published in a journal of school mathematics, the aim of that journal was never to rehash syllabus content, but rather to provide enrichment material for extra-syllabus study. It is nowhere envisaged that a study of group theory should form part of the school curriculum, especially in the years K–10. Furthermore, there is an important distinction to be made here. It is not asserted that, for example, the Kariera, one of the groups Lausch discusses in this context, engage in group-theoretical discourse; this aspect was provided by the mathematician André Weil and elaborated by other mathematicians such as Lausch. In other words, the mathematics involved is not a product of Aboriginal culture; its *referent* is, but that is not the same thing. The group theory comes from mainstream western tradition.

The discussion of the algebraic concepts inherent in storytelling, that is, myth, is even more fraught. Probably the best account available is that offered by Pekonen in the course of his review [16] of material deriving from the writings of Lévi-Strauss. Having given a precise sense to a vague pseudo-mathematical formula announced by that author, Pekonen proceeds to use it to analyse a Jivaro myth (from Ecuador) via quaternions. He succeeds in this particular case, but expresses doubt as to the generality of his study. Again, even supposing that some Aboriginal story could be found which lent itself to successful discussion in such or

similar terms, this would hardly be material to form part of a core curriculum in mathematics. And again the point is there to be made that the *mathematics* here is not a creation of the Jivaro themselves; it has been supplied by Pekonen, and (at a distance) by Lévi-Strauss and his mathematical mentor Weil.

The draft curriculum [1] suggests: 'Aboriginal and Torres Strait Islander peoples' perceptions of time and weather patterns' as a suitable topic for mathematical exploration. It is nowhere indicated how this might be done. Western culture has developed elaborate means to measure time and it remains a matter of great ongoing research effort to understand weather patterns. The mathematics involved in both these enterprises is intricate, involved and (in the latter case) at times controversial. We would be foolish in the extreme to attempt to teach this material in any detail at the school level. It would be even less useful to introduce at this same level less precise notions of these phenomena. Our mainstream culture, the culture that *all* Australians will inherit, needs the precision of modern science. Earlier cultures did indeed develop accounts of such matters, and these served them well through many millennia; however, they are nowadays superseded.

The draft curriculum [1] goes on to say:

> ... when considering the idea of seasons in measurement and geometry, the European tradition of four seasons can be compared and contrasted with the different constructs used by Aboriginal and Torres Strait Islander people in different parts of the country.

Again, counting seasons is *not* mathematics, and quite how it relates to measurement and geometry is anybody's guess! (It was, in fact, a commonplace in the geography lessons of my own primary education in Tasmania to note that other parts of the world—including Australia's tropical north—conformed to different seasonal patterns from our own.)

The further suggestion [1] that 'The idea of using symbols as a way of generalizing relationships can be enhanced by drawing on the perspectives of Indigenous Australians' is so vague as to be quite meaningless.

It surprised me that neither Cohen [5] nor the draft curriculum [1] gave any notice to Aboriginal astronomy. This has recently found a strident champion in Norris [14], [15] (and see also [20]). Once again the case, though forcibly presented, remains less than convincing. For example, Norris claims [14] that the Aboriginal understanding of eclipses indicates strong mathematical underpinning, but in fact his evidence for this assertion is weak in the extreme. All he produces is the Aboriginal recognition that solar eclipses result from a conjunction of the sun and the moon. This is really glaringly obvious and furthermore involves *no* mathematics. Were there an Aboriginal method of *predicting* eclipses, then his case would surely be made, but he avoids this issue. Astronomy has historically been seen as a branch of mathematics, but this classification refers to quantitative astronomy, not to the mere naming of constellations and the elaboration of stories concerning them.

In summary, therefore, the passages under comment seek to introduce into the National Mathematics Curriculum a topic (Indigenous Mathematics) which strictly

speaking does not exist. Although the intention is well-meant and laudable, it is misdirected. Aboriginal and Islander cultures are not well-served by seeking to bestow upon them qualities that they do not in fact possess.

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