Ethnomathematics and education:

Some thoughts on the allegation of recent developments and current directions

Two and two make four/ They never make five
And as long as we know it/ We can all survive
(Graham Nash, *Songs for Beginners*)

Abstract

In 1996, Barton wrote: 'Very little of the ethnomathematical literature is explicit about its philosophical stance', which he considers to be 'one of the areas' that 'must be addressed if the subject is to gain wider legitimacy in mathematical circles'. In 2003, Barton, Adam and Alangui took issue with a recent, critical investigation of ethnomathematics, especially of its relationship with academic mathematics regarding teaching and learning. They dismiss the largely philosophical questions raised by Rowlands and Carson by suggesting that 'the role of ethnomathematics in mathematics education is now predominantly an empirical matter'. What has happened in the interim that has contributed to this alleged shift? Is it true, now that the political and philosophical questions have been taken care of, that ethnomathematics is used successfully 'as a framework in the teaching of mathematics'? This view appears to rely for its plausibility partly on the work discussed in the two International Congresses on Ethnomathematics, and partly on the 'promise' of studies in indigenous knowledge. The underlying idea is that a philosophical, conceptual inquiry regarding ethnomathematics is now passé – *and that any critique must address the empirical issues around curricular reliance on ethnomathematics and evaluate the results. In this paper, I argue that any dismissal of philosophical engagement with the plausibility and viability of ethnomathematics on the grounds alluded to above smacks of mere verbal legislation. Furthermore, I illustrate, through an analysis and critique of recent perspectives, that the philosophical debate around ethnomathematics is both alive and warranted – indeed, crucial.*

Introduction

In 1996, Bill Barton writes: 'Very little of the ethnomathematical literature is explicit

about its philosophical stance', which he considers to be 'one of the areas' that 'must be

addressed if the subject is to gain wider legitimacy in mathematical circles' (Barton,

1996, p. 201). Seven years later, Barton, Shehenaz Adam and Wilfredo Alangui (Adam, Alangui & Barton, 2003) take issue with a recent, critical investigation of ethnomathematics, especially of its relationship with academic mathematics with regard to teaching and learning. They dismiss the largely philosophical questions raised by Stuart Rowlands and Robert Carson (Rowlands & Carson, 2002) by suggesting that 'the role of ethnomathematics in mathematics education is now predominantly an empirical matter' (Adam, Alangui & Barton, 2003, p. 327).

What has happened in the interim that has contributed to this alleged shift? Is it true, now that the political and philosophical/ conceptual questions have been taken care of, that ethnomathematics is used successfully 'as a framework in the teaching of mathematics' (Adam, Alangui & Barton, 2003, p. 334)? This view appears to rely for its plausibility partly on the work discussed in the first two International Congresses on Ethnomathematics (Contreras, Morales & Ramírez, eds, 1999; de Monteiro, ed, 2002) and by Barton himself (Barton, 1999b), and partly on the 'promise' of studies in indigenous knowledge. The underlying idea is that a philosophical, conceptual inquiry regarding ethnomathematics is now dated, *passé* – and that any critique must address the empirical issues around curricular reliance on ethnomathematics and evaluate the results.

My aim in this paper is twofold. I argue that any dismissal of philosophical engagement with the plausibility and viability of *ethno*mathematics on the grounds alluded to above smacks of mere verbal legislation. Furthermore, I will illustrate, through an analysis and critique of recent perspectives, that the philosophical debate around ethnomathematics is

both alive and warranted – indeed, crucial. I argue that 'ethnomathematics' makes, at best, limited sense, namely insofar as it is understood as describing 'indigenous mathematical *practices*'.

Seeking refuge in research on indigenous knowledge is misguided, in that the idea of 'indigenous knowledge' faces serious and potentially fatal objections (see Horsthemke, 2004a; Horsthemke 2004b). Moreover, *very few* philosophical debates have dated. *Very few* philosophical puzzles and problems have been resolved. (The freedom/ determinism debate and the mind-body problem may be among these few.) So, to suggest that ethnomathematics has shifted towards predominantly empirical matters is to proceed in terms of unwarranted verbal arbitration. Insofar as ethnomathematics continues to involve a questionable understanding of knowledge and truth, any such ruling is likely to beg the question of the very validity and conceptual soundness of the ethnomathematical enterprise.

'Ethnomathematics', shifts in definition and direction, and current developments

In his 1996 article, Barton traces definitional shifts within ethnomathematics by examining chronologically the work of Ubiratan d'Ambrosio, Paulus Gerdes and Marcia Ascher, respectively. He explores the development of ethnomathematics 'into a research programme, with a broader referent', that 'now includes: a) the formation of all knowledge (D'Ambrosio), b) mathematics in relation to society (Gerdes); and c) mathematical ideas wherever they occur (Ascher)' (Barton, 1996, p. 210). Building on

these ideas, Barton presents the following definition: 'Ethnomathematics is a research programme of the way in which cultural groups understand, articulate and use the concepts and practices which we describe as mathematical, whether or not the cultural group has a concept of mathematics' (Barton, 2004, p. 214). D'Ambrosio's understanding is strikingly similar but also contains an emphasis on both 'philosophy' and pedagogy: 'Ethnomathematics is a research programme in the history and philosophy of mathematics, with pedagogical implications, focusing the arts and techniques (*tics* [from *technē*]) of explaining, understanding and coping with (*mathema*) different socio-cultural environments (*ethno*)' (D'Ambrosio, 2006).

Barton's 1999 article constitutes an 'attempt to note … the current directions in ethnomathematics' and 'other well-established developments': the 'use of resources derived from other cultures in mathematics education' or what might be called the cultural resource direction, one that appears to have a predominantly practical or empirical focus; D'Ambrosio, Gerdes and the 'humanistic mathematics' direction; and 'the academic debate concerning the philosophy, legitimacy and relationships with other disciplines and theories', that is, 'the critical mathematics direction' (Barton, 1999a, p. 32). These different 'directions' are clearly intimately linked and the boundaries between the cultural resource direction, the humanistic mathematics direction and the critical mathematics direction overlap, as Barton acknowledges later (Barton, 2004, p. 22).

Three years later, Rowlands and Carson publish a critical review of some of the ethnomathematics literature. In response to the question, 'What would an

ethnomathematics curriculum look like and where would formal, academic mathematics

fit in such a curriculum?', they argue that 'it is only through the lens of formal, academic

mathematics sensitive to cultural differences that the real value of the mathematics

inherent in certain cultures and societies be understood and appreciated' (Rowlands &

Carson, 2002, pp. 80, 79).

In their response to Rowlands and Carson, Adam, Alangui and Barton contend that

'debate on cultural issues in mathematics … must be based on contemporary writing in

the field, and should not focus on extreme views within the political justification for

ethnomathematics' and assert that 'the role of ethnomathematics in mathematics

education is now predominantly an empirical matter' (Adam, Alangui & Barton, 2003, p.

327). This contention evidently begs the question of the validity and soundness of the

concept of ethnomathematics. It mistakenly assumes general agreement on what

ethnomathematics *is* and on its 'legitimacy in mathematical circles', to use Barton's

earlier phrase' (Barton, 1996, p. 201).

After noting two perspectives on ethnomathematics, the 'political perspective', 'now

more often related to writing on indigenous knowledge' (Adam, Alangui & Barton, 2003,

p. 328), and the philosophical perspective (including the question of 'mathematical

relativity'), the authors assert,

> 'Whether … [an ethnomathematical] perspective helps fulfil the aims of
>
> conventional mathematics is no longer a question that is debated on ideological

lines. For some time it has been regarded as an open empirical question by most

of those working in ethnomathematics.' (Adam, Alangui & Barton, 2003, p. 330)

Does this not amount to verbal legislation? The claim that this is the view of 'most of

those working in ethnomathematics' fails to establish anything. After all, the majority

may simply be wrong, misled, biased, and so on.

The authors state, further, that

'[e]ducational research is so far demonstrating the success in conventional terms

of at least one ethnomathematical approach to the curriculum. Any critique of this

field must address such results and evaluate them as research. It must enter

current debates. It cannot be ideologically directed, nor is it helpful to address

antiquated or extreme positions.' (Adam, Alangui & Barton, 2003, p. 333)

Adam, Alangui and Barton cite the work done in Alaska (described in Lipka, 2002) as an

example of 'students who have been taught using such an ethnomathematical curriculum

[and who] perform better on conventional mathematics tests' (Adam, Alangui & Barton,

2003, p. 333). Yet, they miss the essential points of the critique of ethnomathematics:

which is to interrogate what is 'culturally specific' or 'unique' about this approach *and* –

if indeed it is so specific or unique – whether it *is* 'mathematics'. This critique has little,

if anything, to do with 'ideology'. On the contrary, it is informed by a plea for conceptual

clarity and argumentational rigour.

Finally, in their endorsement of 'an integration of the mathematical concepts and

practices originating in the learners' culture with those of conventional, formal academic

mathematics' (Adam, Alangui & Barton, 2003, p. 332), the authors do not address Rowlands and Carson's concerns. The latter do *not* 'claim that mathematics should be taught in an artificial setting without relating it to the real-world whatsoever' (Adam, Alangui & Barton, 2003, p. 333; Rowlands & Carson, 2004, p. 336)). Instead, they argue that

> 'a teacher ought to be sensitive to cultural experience …, [but that] to confuse the boundaries between cultural experience and high-order abstract concepts in mathematics is to confuse different cultural systems … All good teachers should be aware of the cognitive state of their students, but that awareness can be achieved by how the student responds to the mediation of high-order concepts. This does not mean connecting high-order concepts with cultural experience.'
> (Rowlands & Carson, 2002, pp. 96, 97, 98)

Of course, it might be argued (as Alangui did, in conversation with me at the recent Auckland ICEM3) that sensitivity to cultural experience and awareness of students' cognitive state are insubstantial and woefully inadequate for addressing the deeper concerns, like the effects of physical and mental colonization. My question is, however, what work does a focus on 'ethnomathematics' do that a rights-based approach does not or cannot do? 'Rights' may be an occidental idea (and certainly not a failsafe one at that), but it is arguably the best tool we have for addressing issues of social justice and redress.

In a recent article, Barton usefully distinguishes between 'mathematical' knowledge and 'practical' knowledge (for example, the 'mathematical' practices of artisans):

'There have been many studies done on these issues: studies in ethnomathematics, studies in mathematics education, studies in situated cognition, studies in anthropology, studies in the history of mathematics and studies in indigenous knowledge. … [W]riting in one area has been criticised as if it was from another. Rowlands and Carson's (2002) critique of ethnomathematics as if it is an educational movement is a case in point, the rebuttal (Adam, Alangui & Barton, 2003) differentiating between the open educational questions, and the ethnomathematical issue of relativity in mathematical thought.' (Barton, 2004, p. 22)

Rebuttal? Hardly. Again, Barton misses the (meta-)issue here. The critique concerns the very plausibility of *ethno*mathematics and *indigenous* knowledge. In order to make sense of ideas like 'relativity' and 'cultural specificity' in mathematics (education), reference to the distinction between 'mathematical' and 'practical' knowledge is crucial. Yet, such reference is usually unavailable within 'studies in ethnomathematics'. Tellingly, Barton notes that

'the boundaries between these areas of study overlap – the differences are often ones of emphasis and focus rather than distinct features. Furthermore, many writers deliberately address more than one of these areas in the same article.' (Barton, 2004, p. 23)

The confusion between theoretical and practical knowledge seems to lie at the heart of the defence of ethnomathematics and of indigenous knowledge in general. In the next

section, I attempt to address this confusion, with particular reference to the ideas of relativity and/ or cultural specificity of mathematics.

Knowledge and truth: The problems of relativity and cultural specificity

After presenting his definition of ethnomathematics (see above), Barton announces, 'Both "mathematics" and "mathematical" are culturally specific because their referents depend upon who is using the terms' (Barton, 1996, p. 214). He claims that there are four implications of his definition: '(a) ethnomathematics is not a mathematical study, it is more like anthropology or history; (b) the definition itself depends on who is stating it, and it is culturally specific; (c) the practice which it describes is also culturally specific; and (d) ethnomathematics implies some form of relativism for mathematics' (Barton, 1996, p. 215).

Before I examine the idea of mathematical relativism in greater detail, I want to comment briefly on Barton's elaborations of points (b) and (c). He writes,

> 'The definition of ethnomathematics is culturally specific: it is written from the
> point of view of one culture or social grouping, namely a culture or social
> grouping which has a conceptual category named "mathematics". … Part of the
> purpose of ethnomathematics is to *challenge the universal nature of mathematics*,
> and to expose different mathematical conceptions. If this is successful, then

ethnomathematics is also specific to one particular concept of mathematics. Thus

a universal definition is not possible.' (Barton, 1996, p. 216; emphasis mine)

Barton accepts that his preferred definition of ethnomathematics, too, is culturally

specific, so he cannot be accused of inconsistency *in this regard*. However, this move

renders 'other' mathematics opaque or unintelligible, and perhaps useless, to anyone

outside the specific culture. Even more seriously, ethnomathematics is rendered immune

to interrogation from without, a sleight of hand I find deeply disturbing intellectually.

Yet, Barton is inconsistent *in another regard*. At bottom, he appears to be unaware of the

tension between the claim that the definition of ethnomathematics is culturally specific

and the claim that part of its purpose is to challenge the universal (or transcultural) nature

of mathematics. Is this purpose also culturally specific? Moreover, the verdict that a

universal definition is not possible presumably has universal purchase. Or is it culturally

specific, too? Barton is silent on these issues. Finally, if it is correct that

ethnomathematics is 'more like anthropology or history', it is unclear how its definition

can be culturally specific. Barton's is a theoretical definition and, as such, subject to

transcultural evaluation, can be seen to be more or less useful – and can also be outright

incorrect, unlike a stipulative definition.

The assertion that the *practice* described by ethnomathematics is culturally specific

makes good sense. However, Barton adds, 'If the practice of ethnomathematics is carried

out with integrity, there will be cognisance of those aspects of the practices and concepts

which are other-culture based and which may not, initially, be considered mathematics'

(Barton, 1996, p. 217). Yet, who judges whether 'the practice of ethnomathematics' is

'carried out with integrity', and on what grounds? Will this not also involve a culturally specific judgement and/ or set of criteria? It would appear that those who are universalists (or transculturalists) about definition and judgement find themselves on logically more compelling grounds.

His definition, Barton says, 'implies two senses in which mathematics is universal, and two senses in which it is relative' (Barton, 1996, p. 218). I take the former two to be uncontroversial, indeed commonsensical, and will not discuss them here. My focus, rather, will be on the alleged senses in which mathematics is relative.

Regarding the first of these, Barton says that

> 'mathematics must be changing. This change needs to be more than just an evolutionary building on what has gone before, it must be revolutionary.' (Barton, 1996, p. 218)

There are well-documented problems with this kind of relativism regarding (revolutionary) change, in mathematics as elsewhere (see Horsthemke, 2004b, pp. 575, 576). To provide just one example, if successive or 'alternative' paradigms are incommensurable, then a new or 'other' paradigm cannot be established to be superior. Barton writes,

> 'Ethnomathematics must admit the possibility of other mathematical concepts which are not subsumable by existing ones, or by some new, overarching generalization. This is not to say that all ethnomathematical study will generate alternative mathematics. What is necessary is the idea that it could happen: that

new ideas could transform the way mathematics is conceived.' (Barton, 1996, p. 218)

Presumably one wants to still be able to call it mathematics (see Barton's point that mathematics 'exists as a knowledge category'; Barton, 1996, p. 218). It follows from this that there is no such thing as 'alternative mathematics': it either *is* or *is not* 'mathematics' proper. (This will become clearer in what follows.)

Regarding the second sense in which mathematics is relative,

'there must be a recognition that mathematics is not the only way to see the world, nor is it the only way to see those aspects of the world commonly referred to as mathematical, i.e. having to do with number, shape and relationships. What is more, there needs to be a recognition that alternative ways of seeing these phenomena are legitimate and valid. For if they are not legitimate, then there will be no point in trying to study them, there would only be point in trying to "educate" those who do not see it in the "correct" way.' (Barton, 1996, p. 219)

First, this is no argument *for* seeing alternative ways (of seeing aspects of the world commonly referred to as mathematical) as legitimate or valid. Indeed, one might simply acknowledge that, on epistemological and truth-functional grounds, they are not legitimate and that there is no point in studying them, other than as anthropological curiosities (like witchcraft, and the like). Second, reference to 'alternative ways of seeing' seems to be misconceived. If a particular alternative procedure can be shown before 'the community of mathematicians' (Barton, 2004, p. 23) to work, then it is not called *alternative* anymore. It is just *mathematics*.

Barton claims that the

> 'use of ethnomathematics as a theoretical tool can be seen as a practical way of acknowledging the reflexivity of [the] relativistic viewpoint: it is the differing conceptions of the field which make it a valuable tool in on-going political and educational debates. We acknowledge that our own conceptions are context-derived, but use that knowledge to continue our work' (Barton, 1999a, p. 34).

Here, as elsewhere, he appears to be unaware of the tension between the 'relativistic viewpoint' and universal knowledge, that is, advancing these ideas as universal knowledge claims. He writes, 'It is an assumption of ethnomathematics that thinking about quantity, relationships and space may vary between cultural groups' (Barton, 1999a, p. 34). Okay – but this does not, indeed cannot, mean that the various views are all equally valid, or that they indicate fundamental differences in mathematical orientation. Barton's final point may indicate a somewhat conciliatory approach, but it contains the mistaken assumption that ethnomathematics is a unique and distinct 'field of knowledge'.

Adam, Alangui and Barton write that the 'political perspective on ethnomathematics … is now more often related to writing on indigenous knowledge', before claiming that '[p]rivileging some peoples' ideas in the discourse of mathematics while denying others' is colonialism' (Adam, Alangui & Barton, 2003, p. 328). 'Such views', according to the authors,

> 'justify the need for indigenous mathematicians to engage in ethnomathematics because indigenous knowledge and value systems are under attack.

Decolonisation involves reclaiming, protecting and valuing the unique ways of indigenous knowing and doing … Indigenous mathematicians engage in ethnomathematics because we know that our peoples have complex knowledge systems that are valuable and could teach the outside world *alternative ways of knowing*.' (Adam, Alangui and Barton, 2003, pp. 328, 329; emphasis mine)

The idea of indigenous ways of *doing* being unique is certainly plausible. However, apart from relying on the unwarranted assumption that 'indigenous knowledge' is an unproblematic notion, this perception is mistaken in a further respect. If anything, 'privileging' or 'denying' views happens on the basis of the respective knowledge or truth content, not on the basis of *who* holds them. Moreover, if these *are* genuine 'ways of knowing', then they would no longer be alternative. They would be part and parcel of 'knowing' as such. If Adam, Alangui and Barton wish to preserve the qualification 'alternative', then what they are referring to, presumably, is not 'knowing' but 'believing'. When the authors assert that 'alternative systems of relationships and their meanings … are important to the growth of mathematical knowledge', they take this to indicate not that 'another world is still possible for indigenous people' but that such a world 'already exists' (Adam, Alangui and Barton, 2003, p. 329). Does this mean that all indigenous worldviews, however scurrilous, are equally valid?

According to Adam, Alangui and Barton, the

'political perspective is just one of many in the ethnomathematical field. The philosophical issues are also far-reaching and widely debated. To name just one

example, the question of mathematical relativity is implied by ethnomathematics and needs justification.' (Adam, Alangui and Barton, 2003, p. 329)

The authors bring this perspective to bear also on their discussion of 'rationality':

'Greek rationality is only one form of rationality, and … the particular form of mathematics that traces its trajectory through a Greek tradition (and a few others) serves particular functions and has particular consequences. … However, to use this particular form of mathematics as the standard by mathematics is to be judged misses the point.' (Adam, Alangui & Barton, 2003, p. 330)

What point?, one might ask. Clearly, in the absence of any kind of argument in favour of (for example) culture-specific rationality, the authors' claim here amounts to little more than bald assertion. Moreover, the claim that there are several (equally valid) forms of rationality renders it impossible to evaluate competing knowledge claims. Even more seriously, *any* kind of behaviour or worldview could be accounted for and rendered immune to condemnation, in terms of employing or engaging a 'different form of rationality'.

Barton explains that '[e]thnomathematics has its focus *firmly fixed* on mathematical knowledge – its aim is the illumination of this knowledge, its methods are to expand the ambit of what can be legitimately regarded as mathematics, *by including* mathematical practices and systems wherever they occur, and, in particular, where they occur in specific contexts' (Barton, 2004, p. 22; emphasis mine). Barton's initial emphasis of the distinction between mathematical knowledge and practical knowledge notwithstanding, this statement exemplifies the basic conceptual confusion underlying the defence of both

ethnomathematics and indigenous knowledge, namely what is in the final analysis a conflation of theoretical and practical knowledge.

Regarding the question, 'How does ethnomathematics extend mathematical knowledge?', Barton points to 'some examples of direct contributions from culturally specific knowledge to the general body of conventional mathematics' (Barton, 2004, p. 23; as an example, he cites Ascher, 2002). I suggest that the idea of 'culturally specific knowledge' makes sense only with regard to practical knowledge or 'mathematical practices' – but *not* when it is taken to refer to theoretical (mathematical) knowledge. Theoretical, factual or propositional knowledge cannot be culturally specific or relative. Neither can truth. Mathematical truths hold transculturally. My hunch is that when ethnomathematicians and indigenous knowledge apologists speak of culturally specific knowledge or of truth being relative, they are actually referring either to practices or to beliefs.

An evaluation of the research around and application of so-called 'alternative' mathematics is necessarily and correctly conducted against the background of 'formal, academic' mathematics. Having said this, I do not share Rowlands and Carson's view that '[the] conversation [between critics and defenders of ethnomathematics, … i]n addition to purely mathematical issues, … involves questions of historical injury and contemporary relationships between *cultural groups whose values are incommensurable*' (Rowlands & Carson, 2004, p. 329; emphasis added). In fact, I would suggest that it is precisely the pernicious cultural and ethical relativism invoked here that would make 'conversation' impossible. On the contrary, I wish to argue – and my recent ICEM3

experience strongly bears this out –, that the degree of convergence between values and priorities is striking and that, despite some historical and cultural divergence in approaches, there is a common commitment to discussion and argument – as well as to standards of reasoning about matters that concern us most.[1]

References

Adam, S., Alangui, W. and Barton, B. (2003) A comment on: Rowlands and Carson 'Where would formal, academic mathematics stand in a curriculum informed by ethnomathematics? A critical review', *Educational Studies in Mathematics* 52, 327-335

Ascher, M. (2002) The Kolam tradition, *American Scientist* 90, 57-63

Ascher, M. and D'Ambrosio, U. (1994) Ethnomathematics: a dialogue, *For the Learning of Mathematics* 14 (2), 36-43

Barton, B. (1996) Making sense of ethnomathematics: Ethnomathematics is making sense, *Educational Studies in Mathematics* 31 (1), 201-233

Barton, B. (1999a) Ethnomathematics: A political plaything, *For the Learning of Mathematics* 19 (1), 32-35

Barton, B. (1999b) Ethnomathematics and philosophy, *Zentralblatt für Didaktik der Mathematik* 1999/2, 54-58

Barton, B. (2004) Mathematics and mathematical practices: where to draw the line?, *For the Learning of Mathematics* 24 (1), 22-24

Contreras. L., Morales, J. and Ramírez, J. (eds) (1999) Ethnomathematics and mathematics education: Building an equitable future, *Proceedings of the First International Conference on Ethnomathematics* (ICEM1), CD Rom, Universidad de Granada, Granada, Spain

D'Ambrosio, U. (2006) 'Ethnomathematics: The scenario 30 years after', plenary presentation, Third International Conference on Ethnomathematics: *Cultural Connections and Mathematical Manipulations*, Auckland/ New Zealand, 12-16 February

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De Monteiro, M., (ed) (2002) *Proceedings of the Second International Conference on Ethnomathematics* (ICEM2), CD Rom, Lyrium Communacacão Ltda., Ouro Preto, Brazil

Horsthemke, K. (2004a) 'Indigenous knowledge' – Conceptions and misconceptions, *Journal of Education* 32, 31-48

Horsthemke, K. (2004b) Knowledge, education and the limits of Africanisation, *Journal of Philosophy of Education* 38 (4), 571-587

Lipka, J. (2002) Connecting Yup'ik elders' knowledge to school mathematics, in M. de Monteiro (ed) *Proceedings of the Second International Conference on Ethnomathematics* (ICEM2), CD Rom, Lyrium Communacacão Ltda., Ouro Preto, Brazil

Rowlands, S. and Carson, R. (2002) Where would formal, academic mathematics stand in a curriculum informed by ethnomathematics? A critical review, *Educational Studies in Mathematics* 50, 79-102

Rowlands, S. and Carson, R. (2004) A comment on Adam, Alangui, and Barton's 'A comment on: Rowlands and Carson "Where would formal, academic mathematics stand in a curriculum informed by ethnomathematics? A critical review"', *Educational Studies in Mathematics* 56(2-3), 329-342

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