REPORT ON THE GEOMETRY WORKING GROUP

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ABSTRACT

There were two contributions to this Working Group. One was by [sa Ochepa who talked about his work on real world geometry and mensuration in Nigeria. The other was by Peter Winbourne who discussed the distinction between the perception of pattern and classification of pattern, in relation to the use of dynamic geometry software. [sa considered Nigerian students' largely negative attitudes towards mathematics and their view of it as an abstract subject. Peter's starting point was that it seems that it is no more necessary for the creation of patterns to have an understanding of their underlying mathematical structure (whatever that means) than it isfor someone to understand the operation of gravity when throwing a ball. As soon as we wish to engage in some kind of classification however (in this case mediated by their construction using dynamic geometry systems), the construct of the underlying structure needs to be addressed.

Isa Ochepa introduced the session by discussing his work on practical mathematics and in particular his work on geometry and mensuration. He began by asking how what can we do to show that mathematics has something to do with our humanity and our own environment.

He used the example of a traditional mud hut from the Northern part of Nigeria as a way of motivating interest on the part of students in a practical application of scale drawing. He also offered the example of constructing pens for cattle as a further application of work on ratio proportion and scale drawing.

It was suggested that in using real world examples there is a need to be cautious since it does not follow that children necessarily see them as mathematics but in fact have other sets of meanings attached. It may be part of our role to evolve a learning culture of seeing the mathematical (as well as scientific aesthetic etc) aspects of familiar objects and settings. These aspects can be seen to overlap rather than negate each other and may compliment and enrich the common-sense functional meanings attached to objects. The work of Terezina Nunes was cited as being particularly relevant in this respect.

Is it a case of imposing 'Western' mathematics on ethnomathematics? Is there a problem? It was asked whether we need to know any mathematics in order to find out how much mud might be

needed to build a hut. It was suggested that I need to know how to build huts - not how to do mathematics.
The motivational aspect of the research was suggested as being the relationship between traditional know ledge (of the master builders) and current know ledge (of mathematics). In traditional societies there were seen to be a few gifted individuals who utili sed intuitive mathematical knowledge. This work was seen to be a way of spreading mathematical knowledge more widely. A parallel analogy was offered of bookmakers. A potential starting point for mathematical activity was suggested by posing the question 'What happens if you increase the size of the hut?'

With regard to these starting points it was suggested that they could be elaborated to match the age and level of thinking of students. Recognising similarity or regularity of 3-D shapes and looking at elements of these shapes such as height or width in standard or non standard units is one thing finding volume of mud used for the walls is another. The latter combines the concept of calculated volume with the concept of the surface area of a cylinder to add to some judgement on effect of drying etc. An investigational starting point at an intermediate level may be to find out what decides the height or the diameter of a hut or the dimensions of a cattle pen. This seems to involve the linking of linear object measurements to personal ones or to some combination of practical factors to be somewhat translated into linear measures. The issue of appropriate accuracy of measurements is another intermediate level facet.

Peter Winbourne made the second contribution to the Working Group on transformation geometry and saw the link with Isa's contribution as being the perception of pattern from a cultural perspective. In the context of transformations of basic units of pattern to produce frieze patterns he asked what we mean by classification. When we try to say what we see in a pattern we may choose to describe it in terms of translations of a motif or in terms of a set of generating symmetries applied to a basic unit.

Choosing to see a pattern as repeated application of generating symmetries to one basic unit where symmetry is seen as an action a mapping a function - places the emphasis on the generative rather than simply the descriptive.

The possibility of this kind of choice has psychological and pedagogical implications. If frieze patterns can be perceived as generative rather than as finished products i.e. static patterns it was suggested that we can be more powerfully be convinced in a different fashion that there is a finite number of different frieze patterns. This involves a shift of attention from the motif to the process to the symmetry as an object. This is also it was claimed a parallel example of what might be taken to characterise developing mathematical understanding in other areas of mathematics (look for example at Sfaard's work or Tall's in algebra.)

What might we expect of children? In relation to symmetries as objects we might ask how do you see it? How might you describe it? It was suggested that seeing transformation as object can lead to a real feeling of conviction and perhaps the possibility of an additional context for reflecting on one's own learning.

A further suggestion was made that we can attempt to generalise this a bit in that the frieze pattern seems one example of many patterns in all cultures which are perceived as wholes. Some are clearly regular such as the Roman Islamic or Celtic decorations others are seemingly irregular but may well be possible to analyse with more powerful tools than we have available in school maths. One analytic approach may be to reduce these patterns to some identifiable elements that can be recombined in different ways. There is a sense in which this process is a basis for creativity in that it retains recognisable elements but creates new forms. The mathematical approach adapted here seems to find the minimal unit and a set of rules which can generate the same pattern as well as related patterns. This generation may well be called a 'Creation Myth in the sense it was not the way the pattern was originally or is still traditionally created. But we are always in the process of recreation and re-constructing. Building nowadays are not built in the same way they were traditionally built. The more creation Myths there are for patterns the richer is the re-construction culture!