Curriculum and cultural values: Lessons from Papua New Guinea - mathematics

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In traditional Papua New Guinean (PNG) society, education centred on tool-making, gardening, fishing, hunting, food gathering, and observation of tribal laws and taboos. Traditional beliefs were based on man and nature. The main characteristic of education was that it was informal and relevant to day-to-day living. This meant that children learnt by observing, listening and doing. Children performed certain functions according to their physical maturity, character and their place in the community. Their belief was what the community believed in. Their role was what the community expected them to do. The rightness or the wrongness of their behaviour was judged by their parents, the sorcerers, the chiefs and the village elders who were strongly backed by the gods and the ancestral spirit. In contrast, schools have used a totally different way of teaching and learning, and a lot of village elders have realised that schools have not made any contribution to the daily living of their young children. Their concern has gone as far as parliament and the government has subsequently put in place a policy of education reform (Kinavai, 1997). This education reform aims to help young people learn what is necessary to live a better life in PNG society in whatever sphere they choose. In particular, at the primary school level it is recommended that teachers (within broad national guidelines) be the mathematics curriculum developers using contexts from their own communities.

This paper critically examines the process of mathematics curriculum development in the light of PNG cultural values and the call for reform, and offers some ideas about how the goal of reform might be achieved in the area of mathematics.

Cultural values in Papua New Guinea

In our society we do not have an inherited hierarchy. We do have chiefs but they mostly get there because they are wise. The son of a chief will not necessarily be a chief. It depends whether the son has the quality or not. If the son does, then he is likely to become a chief. In choosing the leader, it is a whole tribe decision. They will observe who is talking sensibly and who is a hard worker and who can lead, and they will recommend who can become the next chief. The chief doesn't make the decisions for everyone. Instead he will call everyone to a sacred place or house and he will put out his ideas. He will say that for this issue I have got this idea, but I want you to give me your ideas so we can make a decision about it. Decision-making is collective. Also, because the leader is a wise man, he can think ahead and see likely problems and he can point these out to the group. One of the reasons he wants everyone to come together is that we have a system where decisions and actions are meant to benefit the whole tribe. Decisions made affect everyone in the tribe, and everyone knows this.

It is also the business of everyone in the tribe to make sure that the children are learning and doing

what they are supposed to do. If a child is left to misbehave or cause problems it would affect the whole tribe, so it is very important to the whole tribe that they make sure that the child at an early age does what the society expects. They believe that it is much better to reinforce what is good for society when the child is still young. In this sense, the tribe has collective responsibility for helping its children adopt the cultural values of its group.

Schools, on the other hand, have not usually co-operated with their communities to help bring up the children in a collective way. This is not only confusing for members of a community but also a problem. It means that the two main influences on children's lives, the community and the school, can pull in different directions, and it means that the community does not know how it can support the school. Often the values of the school will intrude and come to dominate by default because the community has the vague feeling that the school represents western technological advancement. Such advancement is thought to be good (using an outboard motor is easier than paddling), but the cost of such advancement and a need for balance is usually not able to be considered.

In our society the way children learn is to always be with their parents so they can see what is being done by the family and will thus know how to live in the society. Gradually they learn to help with the things that the family does, according to their age. For example, when they are small they may just carry the water containers or make the fire while the parents are working, but as they get older they are allowed to participate until they are big enough to help with heavier work and to gradually do it independently. Learning is by watching and imitating and participating in real things such as tying ropes, and being guided by our parents. Schools, however, have tended to ignore the strengths of this approach to learning and used a far more abstract approach, as explained later in this paper.

In summary, the values underlying much of PNG society are collective responsibility and decision-making, respect for wisdom and skill, learning via participation with 'expert' others in authentic contexts, and an appreciation of nature. At the same time, the great variety of cultures means that there are many different ways in which the world is viewed in Papua New Guinea.

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The changing mathematics curriculum

As with the primary curriculum generally, the mathematics curriculum has been through various phases. According to Brammall and May (1975), the first was a simple imitation of the colonial ruler's curriculum, followed by an adaptation of the Australian curriculum to local conditions, and then an attempt to develop a local curriculum (although this used content to do with coastal PNG because it was accessible to the curriculum writers).

Brammall and May (1975) note that a major concern for the curriculum developers was that PNG children seemed to lag behind European children in mathematics by as much as three years. This led to an interest in the experimental work of Dienes. Dienes stressed a discovery approach to learning in mathematics though the manipulation of various materials and apparatus. The outcome was a Dienes' influenced programme known as TEMLAB (Territories Mathematics Laboratory) first written in 1968. It covered the first three years of primary schooling. Subsequent evaluation led to a decision to rewrite the programme before proceeding with the final three years.

The rewrite and extension took the form of *Mathematics for Primary Schools.* It had both teachers' guides and pupils' books. The teachers' guides showed how to work out particular content, and also had answers to the activities in the pupils' books. The pupils' books contained worked examples at the beginning of each topic, and then a series of activities for the children to do. Each grade level had a textbook for the first two terms (Book A) and another for the second two terms (Book B). At Grade 6 there was also a Book 6C intended for revision before the national examination.

Nature of the mathematics curriculum prior to reform

Curriculum materials

The curriculum materials seemed to assume that the appropriate order in which to teach mathematics is to begin with skills and facts, then go on to concepts, and finally use these for problem solving. The problems may be drawn from some part of PNG society. For the most part, however, they were not because many of the curriculum writers were foreign. In short, the content was usually abstract numbers and not in a context that was meaningful to most children.

Teaching

In keeping with the sequencing of the curriculum materials, the teaching of mathematics in PNG primary schools largely followed the western model of teachers transmitting the mathematics knowledge to be learnt, and the children being expected to passively absorb it. Teachers explain the skills and facts (and later the concepts) and then the children do the exercises to try to learn them.

Language of instruction and learning

Although almost all children entering PNG primary schools do not speak English, the language of instruction and the medium of communication in schools has been

English. This makes it very difficult for children learning mathematics; they are trying to learn the language of instruction at the same time as they are learning the subject.

Usually this means that they have to try to translate the teacher's English instructions into their own language to make sense of them, work through the tasks in their own minds in their mother tongue, and then translate their solutions back into English to communicate them to their teacher.

Fortunately this language policy has changed with the recent curriculum reforms to take into account insights from psychology which indicate that children learn best when symbols are explained in language that children know well.

Curriculum development and dissemination

Until the recent reform, the mathematics curriculum has usually been written by a small group of 'experts' and handed down to teachers by the Curriculum Unit of the Department of Education. Teachers were told to do just what was in the curriculum - in practice, the textbooks. The same message was given to student teachers in their mathematics education programmes. Furthermore, as noted previously, contexts for learning were collected mainly from the few accessible coastal and highlands cultures in PNG so while they may have suited some parts of the country they certainly did not suit all, given the wide cultural diversity in the country.

Comments on the pre-reform mathematics curriculum

Curriculum materials

Although the textbooks were designed to support teachers who may be insecure in teaching mathematics, they nevertheless seem to have held back the mathematics development of PNG children. There is little evidence that the textbooks take into account that

(i) mathematics is no longer thought of as a static body of truths, but an ever-developing human construction in which process is just as important as product,

(ii) children do not learn mathematics ideas and processes by absorbing them piece by piece from instruction and exercises, but rather by investigating, problem-solving and reflecting on mathematics experiences that hold some purpose and meaning for them, and

(iii) materials that are not linked to the children's own communities can actually turn the children away from their communities since they see no relevance in them for success in school learning. If anything, the curriculum materials suggested that success is associated with town life, not village life.

The mathematics textbooks also put a lot of pressure on teachers and children, for two reasons. Firstly, they demanded to be finished by the end of the second term in the case of Book A, and the end of the year for Book B. School administrators usually carefully monitored that this was happening. Secondly, the national examination at the end of Grade 6, which determined who was able to continue their schooling and therefore have the chance of a supposedly 'better life', was based on the content of the textbooks. The result has been that many teachers have not had time to carefully analyse their teaching, they have come to rely on the textbooks, and the actual mathematics needs of the children have often not been addressed.

Teaching and language

The delivering of the curriculum by teachers has been different from the way the children learn at home. At home, learning occurs through participation in authentic contexts whereas at school mathematics is presented largely as abstract numbers, skills and ideas taken out of context. As Kinavai (1997, 7) observed,

> *Mathematics has ... not been taught as a 'holistic' subject. This has resulted in the inability to link one concept to another or use the skill from one in the other. The reasoning and investigative skills have been lacking in the previous curriculum. The curriculum should include more practically relevant everyday maths.*

The language of the home and local community is shared and meaningful; in contrast the language of the school is foreign and difficult to comprehend. Not surprisingly, some children begin to feel stupid in school and drop out. Most keep going but do not learn very much mathematics. As a consequence, PNG children find that mathematics has little relevance for their life beyond school. This situation is similar to that described by McMurchy-Pilkington (1997) in New Zealand. She concluded that the way mathematics is taught to Maori children in schools contradicts the way in which the children learn at home.

Curriculum development and dissemination

Unlike their input into community decision-making, PNG primary teachers have had little or no opportunity to contribute to the development of the mathematics curriculum. In other words, the top-down model of curriculum dissemination is the opposite of the bottom-up approach to community development and decision-making.

The reform initiative

Reform policies recently endorsed by the PNG government (Kinavai, 1997) acknowledge that a curriculum that requires young children to learn subjects such as mathematics in a language that they are just being introduced to, and that (unintentionally) devalues home, village and rural life, needs changing. The reform policies have separated primary schooling into an elementary level (ages 6-8 years) and a primary level (ages 9-14 years), and have recommended that:

- the language of instruction in the elementary schools be the vernacular,

- the lower primary level be a bridging time when the vernacular is maintained but children are introduced to the chosen national language - English - and gradually become bilingual so that by the end of upper primary all instruction is in English,
- the elementary mathematics curriculum in schools be based on the local community and culture (within national guidelines) and use an integrated thematic approach (see Kinavai and Biddulph, 1998),
- the elementary teachers be trained in mathematics curriculum development,
- the primary mathematics curriculum be nationally prescribed and resourced, and address national issues, but that teachers be "still encouraged to use good local resources and deal with important local issues" (Kinavai, 1997, 3),
- there be an emphasis on problem solving and investigative skills in mathematics (a bridging book having been produced for lower primary teachers for this purpose).

Comments on the curriculum reform

These reform measures are an important step in addressing the shortcomings of the mathematics curricula that PNG has used until now. They indicate a change in perspective about the nature of mathematics to include the critical process dimension. They reveal a willingness to address the crucial language issue, and they recognise the need for meaningful local contexts. Bringing teachers into the curriculum development process, especially at the elementary level, may have been done for logistical reasons but it is also likely to have the effect of teachers taking greater ownership of the mathematics curriculum. In this sense, the development of the mathematics curriculum using teacher expertise is more in keeping with the cultural values underlying community develop. The use of local contexts, particularly at the junior level, is also in keeping with the environment in which children learn about life in their community.

The reforms assume that teachers can not make these changes automatically, and will therefore need training in curriculum development. My experience suggests that this assumption is probably well-founded. Teachers will need considerable education in curriculum development and ongoing support to enable them to become classroom mathematics curriculum developers.

As part of such professional development most teachers will need help to view and teach mathematics education differently. To date they have known nothing other than a behaviourist (transmission/ absorption) approach to teaching and learning. Professional development efforts should be directed toward assisting them to see teaching and learning from a constructivist perspective. Research in mathematics education in recent years has shown that most meaningful learning occurs through children extending or reconstructing their present ideas, rather than memorising facts, figures and foreign words. This means that professional development courses and curriculum materials must guide teachers in the art of

- exploring the ideas that children bring to their mathematics learning,
- providing experiences and interactions that challenge children to develop their ideas further, and
- understanding what sense the children make of the experiences, and what mathematics they construct from them.

Such a professional development programme would lessen the need for textbooks, which in turn would take the pressure off teachers to cover the textbooks, and allow them to focus more on the children's learning. They would also begin to see that the traditional approach of teaching skills, facts, concepts and then applying these to meaningful problems could be completely reversed, as in the Realistic Mathematics Education model developed by the Dutch (Carr and Treffers, 1996).

Along with such professional development for teachers, it is important that curriculum development in mathematics is regularly informed by research - otherwise development is occurring by guesswork and could be wasting valuable education funds. It would therefore be advisable that the Curriculum Development Unit include an ongoing programme of mathematics education research in its work. This could include research undertaken by teachers in various parts of the country, perhaps as part of professional development activities and/or degree or advanced diploma studies. To map out a suitable research programme would require a paper itself. However, among other things, it would likely investigate effective ways of enabling teachers to implement the reforms in the way intended, and the effect of such implementation on children's learning in mathematics.

References

Brammall, J. and May, R.J. (1975) *Education in Melanesia.* Canberra: Australian National University.

Carr, K. and Treffers, A. (1996) Mathematics education in the Netherlands: Realism in school mathematics. *SAMEpapers 1996.*

Kinavai, E. (1997) Curriculum development in science, mathematics, technology and computing education: Country Report - Papua New Guinea. Paper presented at UNESCO Curricula Pasefika Workshop, University of Waikato, 24-28 November.

Kinavai, E. and Biddulph, F. (1998) Community mathematics. *Teachers and Curriculum,* Vol.2. Hamilton, University of Waikato: Leaders Press.

McMurchy-Pilkington, C. (1997) Maori and the maths class. *N.Z. Education Review,* 17, September, p.12.

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