

# Evaluating the Professional Learning for *Cultural Mathematics* in Papua New Guinea's Elementary Schools

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Qualitative and quantitative data are both being used to evaluate a large project in remote areas of Papua New Guinea. Results from teacher and student questionnaires are yet to be evaluated. The responses from teachers participating in the project workshops are reported here to be extremely positive towards the content and delivery of the workshop.

Evaluating a large project in remote areas of Papua New Guinea is a challenge. The Professional Learning for *Cultural Mathematics* in Papua New Guinea's Elementary Schools project is being evaluated both quantitatively and qualitatively. This paper reports the qualitative results from two of the first week-long workshops from the project, one conducted in Hela and one in Hela and Tubusereia. We present evaluations from both teacher participants in the workshops and from the facilitators. The teacher evaluations were collected at the end of each workshop. Facilitators, who are members of the project team, wrote a reflective evaluation after the workshops. The evaluations at this early stage serve a formative purpose for the design-based project, as we assess whether the workshop is providing needed and appropriate professional learning for the teachers.

## Teacher Evaluations from Workshops

The teacher evaluation process was developed using the think, share and summarise method. The responses to questions were individual and then groups selected the most common responses. We also collected the individual written responses. The teachers were asked to evaluate the content of the workshops such as the key principles and how they might use them in planning, the inquiry method, and the use of activities suitable for children. They were also asked about their involvement in the workshop, changes in their views and to what extent they felt they had personal ownership of the new ideas they had encountered. Finally they were asked to suggest improvements. The responses have been overwhelmingly positive with evaluations highlighting a few critical points for the project. We present illustrative individual quotes that represent the most common responses. Quotes are labelled "Hela" or "Tubusereia" by group, but as the quotes were collected anonymously, we do not indicate individual participants.

### *Key principles, inquiry method and other content*

The key principles are a set of ideas and practices that provide the structure and content for the workshops. The key principles were appreciated as being "relevant and vital for identification of mathematical concepts that exist in the everyday life of a child in the

2014. In J. Anderson, M. Cavanagh & A. Prescott (Eds.). *Curriculum in focus: Research guided practice (Proceedings of the 36<sup>th</sup> annual conference of the Mathematics Education Research Group of Australasia)* pp. 738–741. Sydney: MERGA.

community” (Tubusereia). Most teachers felt they had considered all the principles in their planning, particularly how children learn mathematical concepts, cultural mathematics, and language:

They are the very core of planning and delivering meaningful mathematics in the early grades and progress-bridge into the next higher level. ... The listed principles and the inquiry approach can be used across different cultures to teach mathematics (Tubusereia).

The principles encouraged questioning and responses to questions that “reflected mathematical ideas, skills and languages present in the cultural and community based activity/ies” (Tubusereia). These were easily “linked to the national curriculum for mathematics at elementary level” (Tubusereia). Appreciation of the key purposes of the workshop is exemplified by this comment:

The importance of culture, traditions, customs and language/s of the society and to live by the expectations of all these is very real. ... to be literate in the local language so as to interpret the mathematical language meaningfully (provides) for satisfactory results (Tubusereia).

The discussions about unpacking cultural activities such as yam planting, fish sharing and types of weaving were particularly valued:

I learned more in the cultural capacity and partnerships because when the villagers modeled (sic) in the blind making and bilum weaving I will go to my own class and teach them about the activity (Hela).

The inquiry method, simulated in the workshop, led to questions, discussion and the identification of mathematical concepts: “the explicitness of the inquiry learning method ... exposed a lot of mathematics concepts that could be learnt within a short space of time” (Tubusereia). Nearly all participants felt the inquiry planning was an excellent approach which was seen to extend from planning to assessment: “Using inquiry approach to plan teaching and learning makes it easy to also plan assessment for the purpose of monitoring individual learners’ progress and achievements in mathematics” (Tubusereia). Some noted the approach was already in line with their teaching, according to the intention of the elementary curriculum: “I do use my own words to teach but using the inquiry method was very helpful” (Hela). A few felt they needed more experience. The manual was also regarded as being a valuable addition to their teaching materials: “The resource manual used in the workshop contains rich resources to help teachers teach cultural maths in schools” (Tubusereia).

### *Workshop participation*

All participants reported feeling involved in the workshop, with most saying they felt very involved. They enjoyed themselves, and felt that they would be able to implement what they had learned in their planning and teaching, such as feeling confident “to draw up good cultural mathematics content scope, plan and delivery ... for a school year. ... My participation ... has given me insights (knowledge) to view elementary cultural mathematics in a new way” (Tubusereia). Teachers commented that they had learnt a great deal about teaching mathematics, asking questions, providing group activities, linking properly between cultural mathematics and school mathematics, and teaching children arithmetic rather than counting by ones and rote learning facts. The sense of ownership and transformation was evident in comments such as “I now belong to these ideas” (Hela); “the new ideas that I’ve learned were not from outside but within myself which I didn’t recognize before the workshop” (Hela); and “I can now plan for cultural maths with this

rich knowledge I acquired from the workshop” (Hela). Some of the teachers felt they still needed to learn more about the ideas in the workshop and about cultural mathematics. The workshop was seen to be advantageous to the children and the teachers, since the teachers could find out “problems faced by students in learning mathematics so that solutions can be based on evidence of students’ presentation in the research questionnaire” (Tubusereia), and then “plan interesting cultural mathematics lessons and teach well, connecting the cultural lesson to conventional mathematics” (Tubusereia).

### *Suggested improvements*

Suggestions for improvements included requests for more workshops, or for longer workshops. Some wanted more time on preparing learning plans, others on developing mathematical dictionaries:

It would be very helpful to have teachers identify the terms in their local language that relate and reflect the concept of mathematics e.g. operation words, comparison words, grouping or sets, direction, positional words, probability etc. This is one of the weakest areas I have observed in the elementary and lower primary classrooms (Tubusereia).

While the process of developing a mathematical dictionary was begun in some of the workshops, in others the time was not available. Time was also seen as an issue for discussing things that were found out in assessing the students:

After [completing] the research questionnaire, participants could come together discuss and present solutions to problems faced by students and teachers in the research and discuss way forward. For example, [the problem might be that] bright students cannot understand the word pattern and [need to] find a word for pattern in their language. Solution: identify activities that can rectify the solution (Tubusereia).

One negative comment involved the focus on traditional culture and language. Tok Pisin has replaced the use of the local language and the traditional cultures of children are diverse. We needed to point out that contemporary cultural activities, such as buying at the trade-store, running a dinghy, fishing and swimming across the fast-flowing river, are as valuable as traditional ones. Another teacher commented early in the workshop that he could not see how culture could be adapted to school mathematics, partly because of the activities that were only for men or for women; this issue was then discussed. Another comment was the use of English rather than Tok Pisin for some participants who were not confident in English in the mixed language group where we could not use a local language.

### Facilitators’ evaluations

Each workshop in the project is delivered by at least two members of the project team. The facilitators reflect together throughout the workshop delivery. More substantive evaluation occurs in the discussions between team members as they compare their workshop reflections. The design-based nature of the project then allows for these evaluations to influence the refinement of the workshop design for future deliveries. As facilitators, it was evident that neither the syllabus outcomes, the teachers’ guides, nor their teacher training had adequately unpacked for these teachers the key foundations of early number and arithmetic or measurement. In addition to the goal of helping teachers draw on their local cultural mathematics, language and practices, we discovered that we had to cover general early mathematical concepts and teaching strategies. Teachers needed to learn about non-counting by ones techniques for efficient arithmetic strategies; open-ended

questions for learning and practice; and measurement concepts such as identifying what attribute they were measuring, how to establish this attribute through activity, what a unit was and how it is used to measure. Work on area and area units was new to the teachers. Some books that could be read to the class or become readers for the children on these topics were provided to assist teachers to improve these ideas in future. Links between patterns and number was also new; the teachers saw patterns as spatial designs. They had no systemic approach to establishing multiplication as equal rows and groups, and how to develop number knowledge using cultural groupings, rhythm and group counting. We have accounted for this by including more on learning experiences to promote children's efficient mathematical thinking in future workshops. However, this adds more to an already crowded workshop. We hope that in future the trainers can work with teachers in their own schools as facilitators or visit for follow-up professional learning.

### Ongoing Evaluation

Teachers complete a questionnaire approximately five weeks after completing the workshop which has questions related to each principle with space for a comment and then a ranking. The questionnaire assesses the extent to which the teachers take ownership of the new approaches to teaching and planning. They are also required to individually assess at least two children in their class and to ask parents (as community members) some questions. The children's questionnaire provides a checklist of possible responses that can be ranked to provide scores. We expect to be able to obtain indicative results on four groups of variables (Clarkson, Owens, Toomey, Kaleva, & Hamadi, 2001): *school variables* such as ecology, infrastructure and language; *teacher variables* including levels of education and training, English fluency, use of Tok Ples (local vernacular languages), cultural capacity and ICT usage; *pupil variables* such as knowledge of patterns including cultural patterns, early school arithmetic and local cultural mathematics; and *community variables* such as recognition of cultural patterns, local cultural mathematics including arithmetic, time, location and direction.

### Summation

It is clear that the workshops are valued and appreciated by the participants. Although we provide some teaching aids that they can take from the workshop into their classes, such as number cards, the focus is on providing teaching ideas at a theoretical and planning level. These early evaluations indicate that the strengths of the workshop include both the language and culture focus and the use of the inquiry method. However, these village teachers need to know more about early mathematical thinking and strategies to promote efficient mathematical techniques. The design has been refined so that future workshops will spend more time on these areas. A two-week workshop might enable us to deliver the material more comprehensively but resourcing is not currently sufficient for this. The ongoing evaluation will enable us to determine the extent of real changes to their teaching practices and to the mathematical learning of their students.

### References

- Clarkson, P., Owens, K., Toomey, R., Kaleva, W., & Hamadi, T. (2001). *The development of a process for the evaluation of teacher education*. Paper presented at the Annual conference of Australian Association for Research in Education, Fremantle.