



Improving the teaching of mathematics in elementary schools in PNG using cultural practices and local languages

The project developed a model for providing professional learning on mathematics teaching for elementary teachers using students' cultural context including cultural mathematics and language

The model was developed and trialled during workshops conducted in different languages and environments. The workshops focused on: a) using the language of the community and learning with English as a second language; b) what mathematics as mathematical thinking and problem solving means for beginning school children and in culture; and c) best practice for teaching beginning school children including questioning and assessment. Workshops were mainly held in villages with researchers who could speak a local language and the lingua franca. The project created both printed materials and an e-resource that attending teachers could take back to their

schools to continue learning. An easy to connect portable solar panel, lithium battery and small touch screen computer were provided. Videos that showed cultural mathematics ideas and that modelled good teaching and assessing practice accompanied the interactive workshop.

Elementary teachers require education by specialists in mathematics education. Teacher trainers need higher degrees in mathematics education and early childhood.

- Teacher educators in the multiple Teacher Education Colleges and Education Officers across the country should have the opportunity for a Masters degree through a program such as the earlier Virtual Colombo Plan program that the University of Goroka and Charles Sturt University held – CSU has a specialist in mathematics education for PNG, a reputation for early childhood/primary education, and experience in supported block residential mode with Indigenous communities and students.
- Many more capable trainers are needed to teach mathematics and how to teach early mathematics well.
- Teachers need to learn how young children learn to count and work with numbers.
- Teachers need mathematics readers and to learn to read to the class involving the children.
- Teachers need to ask questions and be resourceful for small group activities so that children can develop their own understanding of mathematical concepts.
- Children need to do the talking of mathematics in a language they understand.

Teachers need to recognise cultural mathematics and hence mathematics as reasoning

- Culturally people use mathematics to solve problems and they have developed systems of practice that need to be recognised and linked to school mathematics

KEY MESSAGES

- All elementary teachers need education by specialists in early mathematics education through participatory learning.
- Teacher educators need MEd education in mathematics and early childhood.
- Teachers need to recognise cultural mathematics and to grapple with the meaning of mathematics in terms of their local language if they are to think and reason well in mathematics.
- Teachers need to practice preparing and delivering weekly inquiry plans that go from cultural mathematics to go deeper and make connections with school mathematics.
- Media such as videos of quality teaching and assessment are needed and an e-resource provided to all teachers via a solar-battery-computer.

- Studying the language used to describe mathematics assists teachers' mathematical understanding and that enables them to help children learn the concepts well.
- Teachers use good bilingual education practices to assist children to speak mathematics in their own languages before or in conjunction with English.

Teachers need to plan for and practice inquiry in mathematics.

- Elementary teachers are professional if they can develop teaching plans. The inquiry plan for a week supports good teaching practice.
- Teachers learn to ask open-ended questions through workshops that use our developed teaching design and supporting e-resource. The teaching design was supported by a professional education plan that covered key mathematical processes, the inquiry approach to teach and facility with the e-resource.
- Teachers need to go further and deeper and to make connections and apply or take action on new learning.

Media such as quality videos of quality teaching and assessment provided with solar for remote teachers.

- Videos engage teachers and assist them to understand good practice. These videos need to be high quality and incorporate the inquiry teaching approach.
- Videos were particularly valuable in the workshop to show how children learn to count and begin arithmetic.
- Videos of cultural mathematics activities assisted teachers to recognise mathematics in their own culture and in the children's lives.
- Videos of assessment by questioning in the classroom and of individuals assisted to show how open ended and diagnostic assessment helps teaching.
- Illustration of games played by children showed teachers how games can be useful for mathematics and how questioning and appropriateness for the topic being taught enabled mathematics learning. Introduced activities interested teachers but needed practice.

Recommendations:

- Media unit should be engaged to make quality videos with team members as advisers or teachers.
- Planning needs to be made for training elementary teachers in all provinces by trainers or lecturers who have had at least one full semester of training in mathematics education.

METHODOLOGY

A design-based research approach involved developing, trialling, and modifying a model for professional learning for mathematics. The initial model incorporated what experience and research told us was important for PNG teachers. We took it to a day workshop with teachers and trialled the questionnaires successfully. We used three ecologies: highlands, coast, and mountainous areas behind the coast; and hence multiple languages. Modifications were made based on researcher reflection, evaluations, and data. After the first trial, we included more on how children learn to count and arithmetic, and tried different assessment formats. We simplified. We trialled the use of videos and computers for delivery, modifying slightly.

- Curriculum should integrate the inquiry approach into subjects in teachers' guides especially in mathematics.
- Clarification for teachers and parents is needed that Standards –based education is the result and can be supported by teacher and/or children using their cultural language and using it to develop early school mathematical concepts.
- Further research is needed into the long-term effects of the model that focused on language and culture, mathematical thinking and early mathematical learning and appropriate teaching.
- The touchscreen computers with the e-resource engaged the teachers and further extension of this technology (solar panel-battery-computer) should be developed

Further reading

Owens, K., Edmonds-Wathen, C., & Bino, V. (2015). Bringing ethnomathematics to elementary teachers in Papua New Guinea: A design-based research project. *Revista Latinoamericana de Etnomatemática*, 8(2), 32-52. <http://www.revista.etnomatematica.org/index.php/RLE/article/view/204>

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