Briefing Note: Best evidence in action exemplar highlights Pacific expertise for ambitious mathematics

To: Hon. Jenny Salesa, Associate Minister of Education
CC: Hon. Chris Hipkins, Minister of Education

Date: 9 July 2019
Priority: Low

Security Level: Low
METIS No: 1182447

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Purpose of Paper

The purpose of this paper is for you to:

Note that a best evidence in action exemplar Ambitious mathematics for young Pacific learners: Dr Jodie Hunter demonstrates algebraic thinking for tivaevae is being released.

Note that this resource highlights the potential of the Wellbeing Budget allocation of $7.2 million for the Developing Mathematical Inquiry Communities (DMIC) intervention for Pacific learners.

Note that the DMIC research and development approach to capacity building, well-implemented, lifts mathematics achievement, develops positive cultural identity and reduces peer bullying.

Recommended Actions

The Ministry of Education recommends you:

Agree that this Briefing Note be proactively released.

Cathryn Ashley-Jones
Acting Deputy Secretary
Evidence, Data and Knowledge

09/07/2019

Hon Jenny Salesa
Associate Minister of Education

22/8/19
Pacific Excellence Developing Mathematical Inquiry Communities (DMIC) - New best evidence in action exemplar

1. A new best evidence in action video series demonstrates Dr Jodie Hunter teaching algebraic thinking for tīvāeae to activate educationally powerful connections for Year 3 and 4 learners at Russell School in Porirua East. This new feature for the Developing Mathematical Inquiry Communities (DMIC) intervention is on Education Counts 1.

2. This resource demonstrates for teachers and leaders how to activate educationally powerful connections to the lives, experiences and identities of learners in a meaningful, non-tokenistic way. Feature content is provided in an Annex to this report.

3. This resource highlights the potential of the Wellbeing Budget allocation of $7.192 million for the scale up for optimal implementation of the Developing Mathematical Inquiry Communities intervention for Pacific learners.

New Investment in DMIC Improving Education Outcomes for Pacific Learners

4. Developing Mathematical Inquiry Communities (DMIC) was the first exemplar selected in the Iterative Best Evidence Synthesis (BES) Programme 2 for its impact on achievement, wellbeing and cultural identity 3.

5. Both Cook Island New Zealand leaders of the DMIC capacity building (Professor Roberta Hunter and Dr Jodie Hunter) won awards for their doctoral theses from the Mathematics Educational Research Group of Australasia (MERGA). DMIC scale up received the MERGA 2018 Research Award for raising Pasifika and Māori Success 4.

6. DMIC professional capability building to scale is a challenging research and development driven process that optimally involves leaders, teachers, teacher aides, parents, Pacific communities and Iwi partners.

7. The new Government investment matters. A 2003 OECD review of expenditure on research and development in education warned of the risks of New Zealand’s low investment in educational research and development:

   'At the same time New Zealand invests far less in research and development of any kind than other developed countries and has far lower R & D personnel per million population than Australia or Western European countries ... New Zealand is successful educationally, but is, by R & D standards, not becoming a knowledge economy'. 5

8. The new exemplar adds to the evidence on-line of the Russell School (Porirua East) implementation exemplar that demonstrates maths improvement in the classes of high implementing teachers over two years (as measured on standardized Progressive Achievement Tests).

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1 https://www.educationcounts.govt.nz/bes/taaveae
2 Developing Mathematical Inquiry Communities https://www.educationcounts.govt.nz/topics/bes/developing-mathematical-inquiry/Introduction
That exemplar focuses on critical factors for implementation success including the role of in-class mentors supporting changes in teaching practice. A New Zealand Council for Educational Research report on achievement at Russell school concluded:

‘Pasifika learners did, on average, score lower than their cohort average. There is variation on how wide these gaps started, but they all tightened over the two year period. By the end of 2016, these gaps were negligible across all cohorts. This could not be said at the start of 2015’.7

Understanding the Developing Mathematical Inquiry Communities Pedagogy

9. The DMIC approach has a ‘low floor, high ceiling’ approach; where the children begin mathematical reasoning with small numbers so everyone can succeed; then have the opportunity to collaboratively problem solve with mathematical challenges that stretch all learners.

10. Four short videos filmed at Russell School demonstrate the DMIC pedagogy:

a. **The Launch**: introduces the children to the mathematical problem and the technical language they need to understand and solve the problem. The problem is based around the Cook Islands tivaeva. Cook Island students recognise the tivaeva and become experts for the lesson. Their classmates respect and benefit from their knowledge.

b. **Group Work**: focuses on the children’s thinking, problem solving and mathematical talk. Crucial to the success of group problem solving are the collaborative problem solving skills required for this ambitious mathematics approach. These skills are taught explicitly through the DMIC Mathematics Participation and Communication Framework. These skills reduce bullying.

c. **Sharing Back**: Dr Jodie Hunter reminds the children of the mathematical and real life problem they are solving as they transition back to the whole class context – this reminds the children of the purpose, maximises engagement and keeps them focussed on the mathematics. All the children have the opportunity to hear the different generalisation strategies of all three groups, and importantly realise that each generalisation works.

d. **The Connect**: a whole class teacher-directed discussion designed to follow up on the ‘So what?’ question for mathematics that works for real life problems. Dr Jodie Hunter uses The Connect to enable the children to generalise from the pattern at a symbolic level.

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Support from the Profession

11. NZEI Te Riu Roa worked in partnership with the Iterative Best Evidence Synthesis (BES) Programme on the demonstration stewardship implementations of DMIC in Porirua East and through a Ngāi Tahu bequest in Christchurch. DMIC has been featured in NZEI’s professional journal in 2018: *Stunning results from culturally responsive maths – Ako*

12. We will be liaising with NZEI to support wider reach; they have asked that this exemplar be made available to as many teachers as possible through a range of communication strategies.

Communications

13. This is regarded as a low risk release. We are preparing communications messages to support this release. These will be provided to your office ahead of the release.

Proactive Release

14. It is intended that this Education Report is proactively released as per your expectation that information be released as soon as possible. Any information which may need to be withheld will be done so in line with the provisions of the Official Information Act 1982.

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[8](https://akajournal.org.nz/2018/07/24/stunning-results-from-culturally-responsive-maths/)
Annex one: Best evidence in action exemplar content

The exemplar can be viewed at the link below. Copy the url into a web browser and then access the draft page by entering the username and password provided. The feature can be accessed through inserting the link into the browser and using the passwords. 

Ambitious mathematics for young Pacific learners: Dr Jodie Hunter demonstrates algebraic thinking for tivaeve

Introduction/Whakataki

In this best evidence in action video feature, Dr Jodie Hunter demonstrates mathematics teaching that activates educationally powerful connections for Pacific learners.

Tahitirei no nga whānau i te whakatauki, ara torihana, i ana nga whānau i te whakatauki i nga whānau e noho ana i te wāwae. 

This demonstration lesson was carried out at Russell School, Pontua East. Find out more about the impact and leadership of this work from the perspective of the Russell School principal, board, teachers, in-classes mentors, parents and children.

What’s the focus of this exemplar on in the mathematics? DrMC was selected as the first BSE Exemplar because the pedagogy with implementation, not only develops mathematics proficiency for all students, but also reduces racism and bullying and increases student belonging, particularly for Pacific, Māori and new immigrant learners.

This video series follows the Mathematics and Statistics / Ratongonone Video 1: The Launch lesson structure. The pedagogy is consistent with the findings of best evidence syntheses.

The lesson begins with a teacher-directed Launch, moves into Group Work followed by each group Sharing Back with the whole class. Craig’s 10-11 the effectiveness of this pedagogy is The Connect that is made to the big mathematical ideas - in this case the emerging algebraic thinking for these Year 3 and 4 learners.

Belonging and Wellbeing. See more about impact here...

Reductions in Bullying

The early change data on student bullying rates across the three Pontua East Schools for the first year of DrMC implementation in 2015 showed marked improvement.

The Trends in International Mathematics and Science Study in 2014/15 found that only two countries was bullying significantly more frequent than in New Zealand for Year 5 students. The early change data indicate (the Pontua East schools showed) reductions in bullying associated with the DrMC implementation from 16.9% to 10.4% of students reporting they were left out of activities at least once a week, and from 29.8% to 21.4% of students reporting being hit, kicked or hurt by other students at least once a week.

Shifts in Unconscious Bias: Inclusion and Belonging

There was change also for students’ sense of belonging at school. Baseline survey at the three Pontua East schools indicated that there were children who, in mathematics, fewer or hardly ever felt good to be Maori, Samoan, or from their own culture. This started changing. For example, in the Year 1, percent, 30.3%, 25.8%, 16% and 9% and in Year 5 percent, 13.7%, 9.2%, 5% and 2%.

The percentage of children who, in mathematics, fewer or hardly ever felt good to be Maori, Samoan, or from their own culture dropped from 0.9% to 2.3% over the seven-month early implementation period.

See the Video on perspectives from the school community on Russell School: The Difference
Ambitious mathematics for young Pacific learners: The Launch

Introduction/Whakataki

Dr Jodie Hunter asks Years 3 and 4 students what the image of a 'akeake (Cook Islands students recognise the 'akeake). These children become experts for the lesson, able to share their experiences of how 'akeake are made and when 'akeake have special significance. The 'akeake is an amazing piece of art. Because an image of a 'akeake has been used, children who do not have direct experience of 'akeake are able to quickly connect to the lesson content and learn from the knowledge of their classmates.

Implementation Points:

What works! Activating educationally powerful connections to the lives, experiences and identities of learners.

What does not work! Allocating identities to learners. See Professor Roberta Hunter explain more in the

Geometry - Connections Toa | Shop | Ngatu section

So, its got really clever maori in them.

The problem is that there is a 'akeake pattern on a cushion, but the group of Māmurau need to know how many leaves will be required for a large quilt.

The lesson introduces the children to the mathematical problem and the technical language they need to understand and solve the problem. The Launch prepares them to move from images to numbers.

Dr Hunter draws the children's attention to the mathematical nature of the 'growing patterns' leaves into the 'akeake.

DNAC mathematics problems are designed to engage children at progressive levels of difficulty so the 'akeake (starts with the 1st position of the growing pattern) but also challenges the children to problem solve at progressive levels of challenge for ambitious mathematics. How many leaves will be needed for different positions from positions 1, 3, 5, 7, 9, 11 (Describe how many leaves would be used for the 26th position on the 'akeake).

The DNAC approach uses a range of strategies to engage a wide range of children in the teacher-directed discussion. So all children are prepared to actively participate in the group problem solving tasks. The children have been challenged to take on the role of Problem Detectors using numbers to solve the problem. The collaborative problem solving unit has been launched.
Ambitious mathematics for young Pacific learners: Group Work

Introduction/Whakataki

The teacher completes the launch and initiates the group work by ensuring that every group is clear about the problem. Each group has to grapple with the challenge to solve the problem.

The focus is now on their thinking and problem solving. But crucial to the success of group problem solving are the collaborative problem solving skills required for the ambitious mathematics approach.

Through the DMAC approach children are taught how to productively talk, group norms and rules for communication, and participation (not give students voice and confidence) and enable effective group work. Find out more about the Mathematics Participation and Communication Framework (2019) Pacific values of respect and care for each other are operationalised in this way.

For many children mathematical argumentation is worrying in case they are seen to be 'not polite' so the children are facilitated in ways to engage in friendly arguing using mathematical reasoning.

Because the DMAC approach has a 'low floor, high ceiling' approach the children begin with small numbers so everyone can succeed. There are four leaves at the centre and growing patterns of two leaves on each side in the 1st position. But generalising to the 16th position is a challenge that will stretch all learners. The interface of the collaborative problem solving and skilled teacher-directed discussion provides a way to realise the ambitious goal for the lesson.

The class groups of children each come up with different generalisations to explain the growing patterns. Each generalisation works.

Throughout the mathematics lesson the importance of the 13-week context reasserts for all of the children that complex mathematics is embedded into Pacific cultures. In this case Cook Islands Māori culture. Ambitious mathematics is part of Pacific identities. This is not colonisation.
Ambitious mathematics for young Pacific learners: Sharing Back

Introduction/Whakataki

The groups have completed their task and are now ready to report back and listen to each other's problem solutions.

Again, Dr Jodie Hunter reminds the children of the mathematical and real-life problem they are solving as they transition back to the whole-class context. In this way the remains everyone of the purpose, maximises engagement and keeps the children's thinking focussed on the mathematics. Throughout the lesson there are examples of longitudinal activation by Dr Hunter to keep children thinking more deeply about their learning without imposing answers or leaving the children to make sense of the mathematics without support.

The Sharing Back enables all the children to hear the three different generalisation strategies of all three groups and to realize that each generalisation works.

I wanted them to see that you could see this pattern as growing in multiple ways because I think it’s really important for children to be able to look at each other’s perspectives and acknowledge that there are different ways of thinking about a problem and different ways of seeing things.

The whole-class Sharing Back session prepares the children for the final crucial session as the Connected lesson sequence. The Connect to the big mathematical ideas.
Ambitious mathematics for young Pacific learners: The Connect

Introduction/Whakataki

The Connect is whole class teacher-directed discussion designed to follow up on the 'So what?' question for mathematics that works for high IQ problems. Dr Jodie Hunter uses The Connect to enable the children to generalise from the pattern at a symbolic level. The symbolic level requires students to replace words with symbols such as a letter to express the generality of the rule.

She asks the children to identify what was the same in each group answer. The children identify the four leaves in the middle of the pattern at a constant no matter how long the pattern grows.

Then she challenges the children to identify another way of saying 6 x 6 = 36. So the children see multiplication - 'it stems' as another way of saying it. She takes the children through a rule that accounts for the constants 4 and 6 for the linear growing pattern.

Dr Hunter asks the class to help her grandmother to work out how many leaves to make for a giant quart.

A rule for the pattern would be 'it stems 4 x 4 = 16. Then Dr Hunter explains that they can use a letter to stand for any position number. So the letter W is used to mean any position number. That's how you would find the answer for any position number.

Dr Hunter then asks the children to look at different position numbers using the new rule. W x W = W

Then Dr Hunter presents the children again with her grandmother's question for the '108' position and asks every child to write their answer and the child next to them to check the rule so that they can answer the question.

The lesson ends with a Cook Islands child answering the question for the whole class 1.8 x 8 = 14 and the other students agreeing with her answer.

Find out more


The document contains several images and a video clip featuring a blackboard with mathematical equations and a group of students seated around a table with their teacher. The text mentions the Mathematics Education Research Group of Australasia (MERGA) and the 10th Malaysian Mathematical Congress. The document also includes a photo of a group of students and their teacher, with the text: "Mersey University Open Speed Mathematical Inquiry Communities team with the Mathematics Education Research Group of Australasia Award for Vision and Impact - Sydney 2018.

Photo: Tom Lowrie (MERGA President) with Dr Jodie Hunter, Trevor Bills, Professor Bobbie Hunter and Janette Bobis (MERGA Vice-President - Research) July 2018."