INSIGHTS

Spotlight on culture and mathematics

The 2022 NMSSA study included an activity that explored the connections ākonga Māori and Pacific learners made between their cultures and learning mathematics and statistics[1]. Nearly 500 ākonga Māori and Pacific learners from over 150 English-medium state and state-integrated schools were interviewed in small groups. This poster describes why culture matters in mathematics, what we found out, and gives some suggestions to enhance classroom practice.

Additional information can be found in the 2022 NMSSA Achievement and Contextual Findings reports for mathematics and on the NMSSA mathematics data window (see https://nmssa.otago.ac.nz/).

NMSSA

Wānangatia te Putanga Tauira
National Monitoring Study of Student Achievement

Te Mahau | Te Tāhuhu o te Mātauranga Ministry of Education

University of Otago Te Whare Wānanga o Otāgo New Zealand

NZCER Rangahau Mātauranga o Aotearoa

Our Cultures and Mathematics at Year 4 and 8

Insights from the 2022 National Monitoring Study of Student Achievement (NMSSA)

Illuminating—why culture matters?

Currently, Aotearoa New Zealand ranks 33rd out of 38 countries in the OECD for levels of educational inequality.[2] In mathematics, ākonga Māori and Pacific learners are over-represented among lower achievers and under-represented among higher achievers in both national and international studies (e.g. NMSSA, TIMSS). The reasons for this are complex. However, research studies increasingly recognise the importance of culturally responsive and sustaining pedagogies in the teaching and learning of mathematics.[4,5]

Research also shows that when teachers treat mathematics and culture as distinct entities, it creates a **disconnect** between ākonga cultural values, understandings, and home experiences and their learning experiences at school.[6,7] By **embracing culturally responsive and sustaining practices** and **challenging deficit thinking**, educators can help reduce disparities and provide equitable opportunities for all ākonga to engage confidently and competently in learning mathematics. [8,9]

Informing—what did we find out?

In our group interviews, ākonga made **strong connections** between mathematics and their cultures and lives out of school. They identified **a range of mathematical ideas** represented within contexts in photographs. Geometry was the most frequently identified area of mathematics, followed by number, algebra, and measurement.

Many of the mathematical activities and experiences ākonga described related to **whānau**, **community**, and **identity**. For example:

- *Enough food for big gatherings*
- *Supermarket shopping—money*
- *Mum uses maths for weaving*
- *Lavalava, measure person's waist*
- *Kapa haka steps and movements*
- *Patterns at the marae*
- *Our culture used to count stars to navigate.*

Many ākonga felt that the cultural contexts they identified were **not typically recognised or represented** at school. Eighty five percent of ākonga **disagreed** that they saw or used mathematics from their cultures when they were learning mathematics at school.

When ākonga did see or use mathematics from their cultures at school, representations were often at a surface level. Ākonga told us they sometimes saw *"a Māori person's name in a word problem"* or *"te reo Māori numbers on the wall"*.

Twenty-eight percent of ākonga felt **positive** about their cultural identities when they were learning mathematics at school.

> *"Good, because [my culture] is starting to get into everything, it's getting more big, so it's in maths."*
>
> *"Excited, because I get to relate it to my culture."*
>
> *"I feel proud of being Samoan during my maths lessons."*

The largest group (68 percent), felt **neutral.** These ākonga believed **that their cultural background was unrelated or irrelevant** to learning mathematics.

> *"It doesn't make a difference because we don't use our culture at school."*
>
> *"Being Māori does not relate to my maths lessons at all."*
>
> *"You're all learning the same thing. It doesn't matter."*

A small proportion (three percent) shared **negative** experiences related to their cultures in mathematics classrooms.

> *"Sometimes it feels weird because I'm the only person with brown skin but I'm used to it now."*
>
> *"I feel different."*
>
> *"If you get something wrong and you're a dark person you might get picked on during the break."*

Improving — how can these insights be used in practice?

Te Mātaiaho, the refreshed curriculum, recognises that **all** ākonga are culturally located and includes parity for mātauranga Māori and mātauranga mathematics and statistics.

To create culturally responsive and sustaining learning environments kaiako can:

- Inquire into the use of **culturally responsive and sustaining approaches** to learning and teaching mathematics.
- Actively seek to understand the **cultural backgrounds** of ākonga. This includes learning about their cultural values, traditions, and perspectives on mathematics.
- **Engage whānau** in learning by creating opportunities for them to share their knowledge and experiences related to mathematics used outside of school.
- Implement **teaching strategies** that explicitly build on the cultures, languages and identities of ākonga as strengths, and align with ākonga values and cultural ways of being.
- Foster **collaborative and inclusive** learning, by encouraging ākonga to work in diverse groups and to value each other's contributions.
- Incorporate authentic, **culturally relevant content** into mathematics lessons, including mathematical examples, problems and contexts that reflect the cultural backgrounds and experiences of ākonga.
- Develop teaching strategies to combine **cultural knowledge and mathematical knowledge**, in ways that **give value to both**.
- Create **safe and inclusive** classrooms where the cultural identities of ākonga are affirmed, their unique perspectives are valued, and all ākonga feel capable of succeeding in mathematics. For example, incorporate **values** that are recognised as supporting ākonga to learn (e.g. manaakitanga, whanaungatanga, and kotahitanga).

For more information on culturally responsive and sustaining pedagogies see the Common Practice Model.

[1] For brevity, the term 'mathematics' is used when referring to the mathematics and statistics learning area.

[2] Chzhen, Y., Gromada, A., Rees, G., Cuesta, J., & Bruckauf, Z. (2018). An unfair start: Inequality in children's education in rich countries, Innocenti Report Card, no. 15. UNICEF Office of Research.

[3] Royal Society Te Apārangi. (2021). *Pāngarau mathematics and tauanga statistics in NZ: Advice on refreshing the English-medium mathematics and statistics learning area of the NZ curriculum*. Author.

[4] Averill, R., Te Maro, P., Anderson, D., Easton, H., & Taiwhati, M. (2020). Bicultural mathematics teacher education and research: Supports and challenges. In C. Nicol, J. Archibald, Q. Xiiem, G. Glanfield, & A. Dawson (Eds.), *Living culturally responsive mathematics education with/ in indigenous communities* (pp. 113-135). Brill.

[5] Hunter, R., & Hunter, J. (2018). Opening the space for all students to engage in mathematical practices within collaborative inquiry and argumentation. In R. Hunter, M. Civil, B. Herbel-Eisenmann, N. Planas, & D. Wagner (Eds.), *Mathematical discourse that breaks barriers and creates space for marginalised learners* (pp. 1-21). Sense.

[6] Louie, N. (2017). The culture of exclusion in mathematics education and its persistence in equity-oriented teaching. *Journal for Research in Mathematics Education*, *48*(5), 488-519.

[7] Parker, F., Bartell, T., & Novak, J. (2017). Developing culturally responsive mathematics teachers: Secondary teachers' evolving conceptions of knowing students. *Journal of Mathematics Teacher Education*, *20*(4), 385-407.

[8] Hunter, J., & Miller, J. (2022). The use of cultural contexts for patterning tasks: supporting young diverse students to identify structures and generalise. *ZDM Mathematics Education*, *54*, 1349–1362.

[9] Saunders, K., Averill, R. & McRae, H. (2018). "I can't wait to get to maths": ako in mathematics teaching learning". *SET: Research Information for Teachers*, *1*, 11-18.