

# THE CHALLENGE OF MOVING MATHEMATICS EDUCATION RESEARCH BEYOND A ‘WHITE SPACE’

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In this article, we aim to add to ongoing conversations related to the challenges of communicating cultural issues in mathematics education. We want to begin by acknowledging that many researchers feel constraints or limitations on publication of their research, however for this particular article we are focusing on the challenges of shifting mathematics education to include voices of students or communities that are typically marginalised. In an article published in issue 33(1), Bussi and Maratigone (2013) ask how we can convey the cultural dimension in mathematics teaching and learning research, and how we can exploit internationally the cultural dimension of a local project (p. 7). Recently, an editorial by Wagner *et al.* (2020) in *Educational Studies in Mathematics* considers how journal publication processes perpetuate inequities within the field of mathematics education. Here, we examine the notion of the review process and publication in international mathematics education journals as a potential ‘White space’ (Barajas & Ronnkvist, 2007) by considering the cultural dimensions and challenges that are faced by researchers working with students at the ‘margins’ when communicating with an international audience.

As two researchers working with young children who are seen to be at the margins of mathematics education, and their teachers, we have often discussed the issues of equity and diversity both in regards to the students we work with and our own research perspectives. Our particular research focuses on students from diverse cultural backgrounds engaging in mathematics tasks that promote early algebraic thinking. This article arose from the challenges of communicating and sharing our research with an international audience, who may not be aware of the cultural background, contexts, and challenges faced by diverse learners within the settings of our countries (Australia and New Zealand). Specifically, we share recent comments made during reviewing processes that have provoked us as mathematics education researchers to reflect both on the meaning of the review statements and how to address our interpretations of the meaning in our work:

You state that studies which have focused on Pāsifika and Māori students in mathematics education have demonstrated the need to develop a balance between the ideology of Western mathematics classrooms and cultural values specific to the group. Why should there be such a balance? Who decides this ‘need’?

It is arguably the case that the cultural artefacts used in this classroom (*e.g.* Tapa cloth) are being appropriated to serve the needs of the school mathematics curriculum (rather than the learner, or their community).

We share these comments as representative of common responses from international reviewers and audiences when submitting conference papers and journal articles or presenting research, which we emphasise can be interpreted in multiple ways. These types of responses raise many questions for us and for the wider mathematics education research community, including: Have we as researchers become too complacent in our understandings of the students’ cultural and educational backgrounds? How does the international community develop their understanding of differing cultural contexts? Have we neglected to share our positionality of ourselves as researchers? How do we articulate the marginalisation that students experience in classrooms in our countries to an international audience? We also echo the questions raised by others in mathematics education research. Are all mathematics education research questions able to be considered within the international community? (Bussi & Maratigone, 2013; Silver, 1994). Whose mathematics education and experiences are valued more than others and deemed important enough to study and publish? (Wagner *et al.*, 2020).

To begin this article, we present individual excerpts acknowledging our own cultural backgrounds and researcher positionality.

*Jodie Hunter:* I am a second-generation New Zealander of Cook Island heritage. My grandmother was born in Manihiki, Cook Islands and brought to New Zealand as a teenager during World War Two to work as a domestic servant. My parents were both born in New Zealand and I grew up with my feet in two worlds, Pakeha (European) and Cook Island Maori. My schooling was within New Zealand English-medium state schools and I never saw my Cook Island cultural background reflected in school mathematics. As an early career researcher focused on early algebra, I did not make links between my Cook Island heritage and patterns.

In recent years, my research has focused on equity for Pāsifika students in New Zealand schools. Pāsifika is an umbrella term for the diverse group of people from Pacific Island nations (*e.g.*, Samoa, Tonga, Tokelau, Fiji, Cook Islands, Niue) and includes both those born in New Zealand

as first or second generation or those who have migrated to New Zealand. My awareness has grown of the challenges for Pāsifika students when their cultural identity and values are missing from classrooms. As Pāsifika people, we have a long history of mathematics through building vaka (canoes), navigation, cultural artefacts and activities. My own cultural background provides one lens to analyse both opportunities for mathematics and classroom interactions within a Pāsifika framework, however, I recognise the diversity of Pāsifika peoples and other Indigenous groups of people.

*Jodie Miller:* I am a first generation born Australian with no Indigenous heritage. My mother is Irish and my father is English. Both my parents arrived in Australia in the 1970s. My schooling was in Australia. Throughout my career, I worked with Aboriginal and Torres Strait Islander communities in Australia, focusing on improving educational outcomes in mathematics. In particular, my research has focused on how young Aboriginal and Torres Strait Islander students engage with early algebraic thinking.

As a non-Indigenous education researcher, I understand that although my own culture deeply influences the perceptions of the world around me those views are not a defining assessment. I recognise that Indigenous people bring unique life experiences to the classroom. Thus, my research takes a strengths-based perspective, focusing on positive educational stories, rather than ‘gaps’ or deficit perspectives. By addressing the diverse mindset of all involved in classroom interaction, we acknowledge and celebrate Indigenous students and educators as knowledge-makers. Through this perspective, all participants contribute to knowledge which adds to the collective understanding.

We began our conversations in 2014, and identified similar challenges we faced in our work. These included:

1. sharing research related to a local context that has specific contextual factors in relation to diversity,
2. drawing on cultural contexts to design tasks for our research, and
3. communicating with an international audience who are not aware of the contextual factors related to culturally diverse learners in different countries.

This discussion article presents our perspectives in relation to the above points when undertaking research in mathematics education. We draw on experiences in communicating our work with international audiences focused on young diverse students engaging in early algebraic thinking to examine each point and raise further questions.

### **When we look for diversity in our classrooms**

In recent years, many Western countries including Australia and New Zealand have had changing student populations that are increasingly diverse. However, the way in which diversity plays out in local contexts given differing cultural backgrounds and the history of how countries were colonised is not universal. We draw parallels with Bussi and Martignone’s argument that researchers in the West, centred in their own worlds, often have a perception of ‘taken-as-

shared’ values or interpretations, including views regarding diversity. Within our work, we view diversity across different frames including students who are diverse from the dominant or dominating culture of our countries and/or diverse within the broad umbrella terms used to categorise heterogeneous groupings of people such as Pāsifika people within New Zealand. Within the international community of mathematics education, can we claim to have a shared understanding of diversity or diverse groups of students? Does a mathematics educator with an understanding of First Nations peoples in Canada have an understanding of Pāsifika people (an Indigenous yet migrant group) in New Zealand? Is this achievable or desirable? How can the mathematics education community “encourage research that builds on the wisdom of local worldviews, not the co-opting or forced adoption of the worldviews of others”, as urged by David Wagner (in Wagner *et al.*, 2020, p. 303)?

We argue that, both in New Zealand and Australia, diverse groups of students are marginalised within wider schooling experiences. While many students come from diverse cultural backgrounds, often this is not acknowledged within schooling, and both content and pedagogical approaches remain the same for all groups of students. This leads to the organisation of education systems where the space is racialised. Whiteness is built into formal and informal practices, making schools White spaces, and with negative consequences for non-White participants who must give up their cultural identity and values to succeed. Similar to the notion of White spaces, Louie (2017) argues that mathematics classrooms are built on a ‘culture of exclusion’ whereby narrow definitions of what it means to do mathematics shape student access to mathematics. This is reflected within work from New Zealand with interviews with middle years Pāsifika students. We highlight below their responses when asked how they feel within mathematics lessons:

Sometimes it makes me feel different because Tokelauans don’t do maths.

It feels like I’m a different person from a Samoan person [*pause*] because whenever I’m learning maths I think I’m a Palagi (White) person [*pause*] because whenever I’m doing maths I can’t remember I’m Samoan. I don’t like about maths when I get up to the hard part. I can’t do it. I don’t feel like a White person anymore I feel like myself again (Samoan) and I’m nervous (Hunter & Hunter, 2018, p. 5)

When hearing students’ lived experiences as the quotes presented, it is easy to address statements and questions such as those provided earlier in the article:

You state that studies which have focused on Pāsifika and Māori students in mathematics education have demonstrated the need to develop a balance between the ideology of Western mathematics classrooms and cultural values specific to the group. Why should there be such a balance?

We argue there should be a balance as students walk in both worlds. It is easy to understand how young students potentially disengage from mathematics at a young age when they

cannot see themselves as part of these learning communities. Thus, both addressing and challenging the ideology of Western mathematics classrooms and balancing this with a focus on values and identity is indeed necessary from the students' perspectives. We have attempted to address this issue with a two-fold approach. First, with the design of mathematical tasks that draw on students' cultural backgrounds or shared contexts and second, pedagogical approaches that provide space for students to maintain their identity in the classroom.

### When we use culturally-located tasks

There are many studies in early algebra focused on pattern generalisation that have been conducted with students from dominant cultures with tasks drawing on geometric patterns set in a mathematical context (*e.g.*, dots, squares, tiles). Of the studies which have a focus on the culturally diverse student groups in the study, the tasks presented generally draw on personal generic contexts (*e.g.*, seating guests for dinner, Carraher, Martinez & Schliemann, 2008), or shared contexts with the teacher and student (*e.g.*, animals, desk plans, Miller, 2016). In the mathematics education research space, these are recognised and accepted as legitimate mathematical growing patterns or 'real' situation tasks without requiring justification of whether they are a mathematical task or a cultural artefact. Scholars have argued that when students are presented with 'real' situations in mathematical tasks, students may draw on their own personal social cultural understandings that reflect closer to a real-life situation. This can potentially result in solutions that are not consistent with the posed 'real' situation task (Palm, 2008). In the field of early algebra, there appears to be little research drawing on culturally located patterns (*e.g.*, weaving baskets, cultural dances, quilting, bark cloth designs) as mathematical growing patterns as a means to link mathematics to students' lives.

The use of culturally located tasks in mathematics classrooms can be a contested area. A number of researchers caution against an uncritical use of ethno-mathematics within schools. For example, Pais (2013) argues that something is lost when every-day activity is transposed into school settings. In addition, scholars have argued that, while authentic resources may be used to underpin the design of a mathematical activity or task, the activity itself may be inauthentic. For example, when using the authentic resources (*e.g.*, basket weaving) in an inauthentic way (calculating surface area), the connection between the real situation and the mathematics task is lost (Vos, 2018). As mathematics educators, we continually work to find this balance.

Similarly, in our experience we have encountered arguments that taking a mathematical gaze to cultural artefacts and then drawing on this within a mathematics lesson appropriates the artefact and then reduces it to 'school' mathematics. However, the groups of diverse students with which we work typically attend English-medium state schools and often experience mathematical lessons with contexts that do not align with their cultural heritage. Consequently, are we as mathematics educators to then argue that this group of students are to experience mathematics lessons where they consistently grapple with unfamiliar contexts before being able to access mathematics? Should we only use de-contextualised tasks? What are the consequences for

specific groups of learners such as the Tokelauan student quoted earlier who views their cultural background as devoid of mathematics? These groups of learners already live with their feet in two worlds. Must mathematics at school be kept separate or can we recognise that mathematics already exists within culturally located patterns familiar to students and can with care be used to promote both a strong cultural and mathematical identity?

We also recognise the importance of teachers, or in our case mathematics education researchers working alongside teachers, and of developing the ability to provide appropriate culturally relevant contexts. We draw on our own experiences in acknowledging that what is seen as appropriate (drawing on cultural artefacts and experiences as mathematics) differs in different locations and according to the position of the researcher.

*Jodie Hunter:* As a researcher of Cook Island heritage, I view the patterns inherent within our cultural artefacts as existing mathematical patterns. Both my own heritage and work within schools and communities with children and families from Pacific Island nations results in familiarity with the knowledge (*e.g.*, tivaevae (quilt) design, cultural performance, hair-cutting ceremonies) held by Pāsifika communities. The affordances that I can bring into my work include the knowledge of cultural patterns from different Pacific Island nations, how these are developed and created, what the items are used for, and their cultural significance.

However, a key constraint when communicating with an international audience is a lack of shared knowledge and perspectives. For example, patterns in cultural items (*e.g.*, tivaevae, tapa cloth) are an inherent part of our life in New Zealand as Pāsifika people. Tapa cloth is used as mats, wall hangings, clothing, and in a range of settings: home, church, school, and for celebrations. However, this is not shared knowledge outside New Zealand and therefore it is difficult at times to make it evident that this is part of everyday life for Pāsifika students. Similarly, these artefacts may not be recognised as already incorporating mathematics through geometrical designs, for example, recent review feedback argued that using tasks based on a cultural artefact (*e.g.*, tapa cloth, see Figure 1), meant that it was "recontextualised as something different—an illustration of patterns".

*Jodie Miller:* Despite the best intention to draw mathematics from Indigenous culture, at times it can be challenging for a non-Indigenous educator to design tasks that are authentic

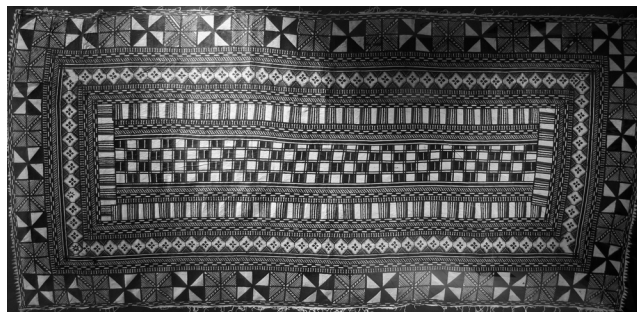


Figure 1. Tapa Cloth.

and culturally empowering for students. Generalising growing patterns is an abstract concept for primary school students and contexts used to teach this are often drawn from traditional mathematical representations (*e.g.*, dots, squares, tiles). While undertaking research in this area, I had ongoing discussions with Indigenous educators to determine mathematical growing patterns that could be seen in their own culture that might be used in the classroom with young primary school students. They indicated that their culture is rich in patterns, including dance, art and kinship models. However, it was determined that some of these patterns (*e.g.*, kinship models and art) would be an inappropriate context for a non-Indigenous teacher/researcher to make connections or allusions to, as this is knowledge that should be shared by an Indigenous person. Thus, in the case of some of my research, it was decided, in consultation with the Indigenous educators, that the best context to draw on was a shared context for both the students and myself/teacher, that is, the school and natural environment.

Drawing from a shared context (*e.g.*, animals, environment, school) proved to be an engaging and powerful way for young Indigenous students to learn and explore generalising mathematical growing patterns. This also provided a platform for students to share where they might see these patterns in their lives, and discuss and share this with their peers. When sharing these findings in an international context, it is difficult to shift thinking in relation to what appears to be an appropriate task, drawing from students' known contexts. For example, it is often claimed that using Aboriginal art would be appropriate for teaching patterning and by implementing this task the teacher/researcher would be enacting culturally responsive pedagogies. While the intention of such comments is to support and strengthen the work, it comes from the perspective that the non-Indigenous researchers/teachers are the knowledge holders. In addition, if an artefact were used without consultation or permission, a teacher/researcher may potentially be appropriating patterns from an Indigenous culture. Building a strong relationship with Indigenous educators, community and parents can provide a way to embed Indigenous culture in the mathematics classrooms in authentic ways. Communicating this to an international audience continues to be a central component in the work that we do.

### **When we write reviews of scholarly papers**

Many of the highly recognised mathematics education research journals have editorial members and reviewers predominantly situated in the regions of Europe or North America. Potentially, this creates barriers for researchers from smaller regions who work with marginalised culturally diverse students, and their teachers, as specific cultural contexts and features are far removed from the reviewers. Developing writing that effectively communicates the stories of culturally diverse learners in different countries is an ongoing challenge. In some contexts, the political history of learners' experiences, and how they are positioned in education, is complex. We see three central issues that contribute to the difficulty of communication of research with culturally diverse learners and sharing the findings of this research in mathematics education. First, a perceived expectation that

deficit framing is required to present the history and current position of marginalised learners. Second, degrees of unconscious bias that appear to exist in the reviewing of manuscripts in relation to cultural backgrounds. Finally, determining the significance of the work, that is, how studies which foreground the voice of marginalised students and their teachers add to the knowledge base which is predominantly populated with non-Indigenous research and a colonised worldview.

### **Taking a strengths-based approach**

As researchers writing from smaller nations and focused on marginalised groups, framing research studies for an international audience requires in-depth explanation of the socio-cultural context and histories of countries that have been colonised, including the effects this has on education. These explanations are often fraught with deficit positioning, retelling stories of students who are underperforming and teachers who are struggling in these contexts. We aim to move beyond this by taking a strengths-based approach and repositioning the conversation, to include examining pedagogy through different cultural lenses. These are stories that are currently missing from the research literature and only rarely shared in the international context. This creates a tension between what is known to those within the context and unknown to others from different contexts. When writing as researchers from smaller nations focused on marginalised groups of learners, there is often an expectation that it is the author's responsibility to provide detailed information on the social and cultural nuances of education systems and classrooms in smaller nations. Whilst we appreciate the need to unpack the setting of the research when the context cannot be taken as shared, this also creates difficulties within the word limit requirements of journal articles and other publications. As an interim way forward, we propose providing supplementary materials to explain the context of learners that is not in the main text. This material could be published alongside the article as an appendix for readers/reviewers who need further information about these specific contextual backgrounds of the learners beyond what is offered in the article.

### **Unconscious/Implicit bias**

Currently, there is little research that understands the implicit biases (unconscious bias) of reviewers in mathematics education research and how these affect review recommendations. Implicit biases are unconscious beliefs about a person's identity or social group and are based on implicit attitudes and stereotypes and can directly impact on one's behaviour (Greenwald & Krieger, 2006). In educational research, this can lead to reviewers making decisions based on unconscious generalisations and preconceptions. It is well acknowledged within fields beyond the social sciences (*e.g.*, health, science), that implicit biases exist in relation to gender, geographical location of the study, language and methods applied to studies. As reviewers influence the decision-making process for handling editors, it is important to understand how these affect the acceptance of, and requested changes to, manuscripts for research which

is culturally and geographically alien to editors and reviewers. While double-blind peer-review is meant to be a mechanism to reduce unconscious bias, in our experiences this does not appear to be working in relation to studies that involved marginalised peoples from minority communities. For example, we wonder how reviewers are making informed decisions in terms of determining the appropriateness of pedagogy and cultural artefacts. What biases are influencing these comments? And how can we as authors address this prior to submitting a manuscript? As a way forward, mathematics educators could develop review workshops or support material for consciousness raising (in relation to racism or colonisation) as part of post-graduate programmes or conferences. Alternatively, future research could be undertaken within mathematics education in relation to understanding reviewers' socio-cultural backgrounds and the impact this has on the acceptance or rejection of manuscripts from marginalised communities. This could include qualitative research to examine the themes of review feedback and results could be shared with reviewers in order to highlight unconscious bias.

#### **How does this add to what we already know?**

We highlight the potential challenge of how reviewers decide the significance of the work and how it adds to the current knowledge of understanding. How is anything that we report on culturally diverse students different to what we already know about non-Indigenous children and teachers who dominate the literature? Scholars argue that this relates to how Whiteness as a global institution continues to impact on mathematics education. The concept of Whiteness privileges White voices while “oppressing those outside the boundaries” (Battey & Leyva, 2016, p. 51). Martin (2019), reflecting on the US education system and inherent anti-Blackness, advocates that rather than incremental reform efforts, the existing White-space system of mathematics needs to be deconstructed by acts of self-determination and by centring the voices of Black people. Reflecting on how this relates to publication in mathematics education, we consider two potential linked issues; (i) by not acknowledging the contribution of alternate cultural views in research, reviewers and editors are managing what knowledge is shared to the research community; and consequently, (ii) we maintain one dominant worldview and a White space in mathematics education which marginalises students, teachers, parents, and researchers by not valuing their voice, experiences, and world-views.

In order for reviewers to see research focused on marginalised communities as a valuable contribution, they need to acknowledge and be conscious of their own cultural frames and limit the comparison of their own lived experiences to other cultural contexts. In contrast, the construct of cultural transposition, described as “observing and considering meanings embedded in the educational practices in other cultural contexts” (Mellone, Ramploud, Di Paola & Martignone, 2019, p. 199) to reflect upon and rethink practices of your own cultural context, offers an opportunity for learning and development. To illustrate this, we can examine the values at the heart of Pāsifika culture, collectivism and col-

laboration. These are values that Pāsifika culture is founded on and drawing on this in the classroom involves pedagogical moves that encourage collaborative learning and discourse. However, reviewers often query how this is different from studies of US ‘reform’ mathematics classrooms, aside from working with a minority community. We argue that this portrays a world view that collaborative learning and discourse were ‘discovered’ in the US by mathematics educators, rather than recognising that other cultures are founded on the values of collaboration, reciprocity, and inclusion, and that these have been used in formal and informal educational settings for many years (Graves, 1974). There is also a need for reviewers to acknowledge the lack of shared understanding of values across cultures and how these may be enacted and reflected differently. This can be aligned with a colonised viewpoint where values are seen only from a Western framing. As an example, a Pāsifika understanding of reciprocity is founded on belief in the worth of giving without expecting to receive (Funaki, 2016). However, reviewers and editors may draw on Eurocentric views or sources to understand the meaning of this value without acknowledging differing meanings or enactment. Specifically, a recent review cited the Oxford dictionary’s definition of reciprocity to critique the Pāsifika frame of analysis used. This highlights how colonised framings perpetuate mathematics education with a need to more openly acknowledge different worldviews.

#### **Conclusions: implications for the future**

Returning to the opening questions—Are all mathematics education research questions able to be considered within the international community? Whose mathematics education and experiences are valued more than others and deemed important enough to study and publish? We believe it is an important time to reflect on these questions, particularly with regards to research that shifts the dominant norms. Sharing research that draws on a broad range of culturally diverse contexts strengthens not only our understanding but that of current and future teachers. In addition, it also demonstrates to people from culturally diverse groups that their story is valued in our research space. When this research is included in the literature, it provides evidence-based examples of tasks and pedagogies which have proven to provide opportunity for students to engage in a mathematics while still valuing and situating their culture. In addition, it also provides a space for researchers to understand the complexity of this research and ways in which cultural perspectives can be valued respectfully.

Broadening the perspectives of the wider research community can only come about through providing more opportunities for these stories to be shared in the research space. Having multiple perspectives from different cultures allows for researchers, teachers, parents and students to see themselves in the broader education agenda. Moving away from a deficit framing of research to a strengths-based approach is an emergent field and will continue to grow in mathematics education. Thus, we propose that all members of the mathematics education community reflect on how your cultural frame and context influences the ways in which you review/gatekeep research from being published.

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Every culture tries to reach above the mere earthly needs of survival. We have found in every culture these kinds of intellectual exercises, these plays and these games, as practices that allow people to approach the considerations that go beyond pure survival. This I see as the need to transcend one's existence. This is always associated with the search for explanations, for understanding and meeting the challenges, which I call the *mathema*.

Ubiratan D'Ambrosio (1932–2021)  
from p. 39 of 'Ethnomathematics: a dialogue'  
with Marcia Ascher in issue **14**(2).

Ubiratan D'Ambrosio (1932–2021) was a pioneer in the field of ethnomathematics (he named it), an advocate for peace (in individual, social, environmental and military dimensions), a member of the FLM Advisory Board from 1992 until his death, and co-editor (with Marcia Ascher) of one of our exceptional special issues, **14**(2). Trained as a pure mathematician, his interest in mathematics education arose in the 1970s when he became aware of the obstacles facing Brazilian children from marginalised groups. At the same time his interest in the history of mathematics allowed him to see current challenges as reflecting the cultural evolution of mathematics. He sought to understand how mathematical ideas are generated and how they evolved through our cultural histories.

One genre of writing Ubi contributed to FLM were reflections on the contributions of influential mathematics educators after their deaths. He remembered Paolo Friere in issue **17**(3), Claudia Zaslavsky in issue **26**(2), and Sandy Dawson in issue **35**(3). I hope to be able to publish writing in this genre marking his passing in a future issue.

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