New Zealand Annual Review of Education (2020) 26: 153-161
DOI: https://doi.org/10.26686/nzaroe.v26.6930

Implementing localised curriculum drawing on a funds of knowledge perspective: Teacher perceptions and challenges

Jodie Hunter, Roberta Hunter, John Tupouniua and Louise Fitzgerald

Massey University

In recent years in New Zealand, there has been a policy shift towards schools 'localising' the national curriculum to align with the context, aspirations, and knowledge of the local community and student population. In relation to mathematics education, this requires educators to understand and value the mathematical connections between diverse students' funds of knowledge and use these to develop mathematical tasks. This article draws on interview responses from a case study of eight teachers from one low socio-economic, culturally diverse school to investigate their initial perceptions and actions to develop an appropriate localised mathematics curriculum drawing on diverse students' funds of knowledge. The findings indicate that teachers viewed it as important to use real and relevant contexts in mathematics teaching. Interview responses indicated that both students and their families were seen as important sources of information. However, there were challenges for teachers to recognise students' funds of knowledge related to mathematics beyond schooling or generic experiences.

Keywords: mathematics education, funds of knowledge, local curriculum, Pāsifika students

Introduction

New Zealand's population includes the largest group of Pāsifika people in the Western world. Our Pāsifika communities are woven from many threads of diverse ethnicities, nationalities, languages, and cultures. This includes recent migrants, those born in New Zealand of Pāsifika heritage, and those with multiple heritages and identities. While our schools in New Zealand are culturally and ethnically diverse, the cultural knowledge of many Pāsifika learners is excluded from the classroom. The cultural capital that shapes schooling practices and curricula remains predominantly Eurocentric. Educators frequently draw on deficit theories about Pāsifika learners, particularly in relationship to achievement in mathematics, a subject area often viewed as "culture-free" (Hunter & Hunter, 2018; Turner, Rubie-Davis, & Webber, 2015). Positioning mathematics as "culture-free" leads to a narrow view of mathematics as contained only within school settings (Hunter & Hunter, 2018).

Equity in schooling can only be achieved when educators explicitly connect to and build on the cultural, social, and linguistic contexts of all students and the 'funds of knowledge' they acquire in their lives outside of school. The funds of knowledge theoretical framing recognises that all people and cultures have bodies of knowledge and skills which are historically accumulated, culturally developed, and support individual/household functioning and wellbeing (Civil, 2016; Moll, 2014). Funds of knowledge is often associated with adult family practices and activity. A further development is 'funds of identity' theory which recognises that dependent on learning experiences and trajectories, children may draw on family funds of knowledge and/or construct their own funds of knowledge (Esteban-Guitart, 2012; Moll, 2014). Within New Zealand, there has been a policy shift towards schools 'localising' the national curriculum

DOI: https://doi.org/10.26686/nzaroe.v26.6930

to align with the context and aspirations of the local community and student population. This also includes recognising and building upon the knowledge of the local community and families (Trinick & Heaton, 2020).

Developing a meaningful, local curriculum requires teachers to understand and value the connections between students' home and community activities across all areas of the curriculum including mathematics. However, limited research has been undertaken in the New Zealand context to investigate how primary teachers develop their understanding of the funds of knowledge related to mathematics of diverse groups of students. In this article, we examine the pre-intervention interview responses from a case study of eight New Zealand primary school teachers to investigate their initial perceptions and actions to develop an appropriate localised mathematics curriculum drawing on diverse students' funds of knowledge.

What do we know about the funds of knowledge related to mathematics of diverse communities?

While there has been a growing body of research studies (e.g., Dickie, 2011; Hogg, 2011; Si'ilata, Samu, & Siteine, 2018; Stahl, Scholes, McDonald, & Lunn, 2021) focused on diverse students' funds of knowledge, there have been limited studies which focus specifically on how families interact in ways related to science, technology, engineering, and mathematics (STEM) outside of school settings. Even less is known about everyday practices related to mathematics of families from non-dominant communities (Civil, 2016; Mills et al., 2019; Williams et al., 2020). International studies exploring funds of knowledge related to mathematics of non-dominant communities often involve interviews with parents to establish mathematics and literacy activities present in household routines (e.g., Takeuchi, 2018; Williams, et al., 2020).

One key finding across studies is that parents frequently have initial difficulties identifying household activities that involve mathematical learning outside of cooking and construction. Targeted support through interviews or discussion groups increases parents' awareness of the mathematics in their everyday activities. Importantly, studies confirm that although parents are active in supporting their children to think about mathematical content, they undervalue their own knowledge and role in their children's mathematical learning. Despite this, while undertaking household tasks such as cooking, shopping, or construction, parents themselves model and promote the use of mathematical processes such as problem-solving, mathematical explanations, and justification. Findings such as these can be used to advance a social justice agenda by challenging perceptions of parents within non-dominant communities and raising educators' awareness of the rich out-of-school mathematical experiences of diverse groups of children.

What do we know about how teachers access the funds of knowledge related to mathematics of diverse communities and use these in the classroom?

Earlier seminal research studies related to students' funds of knowledge largely involved intervention studies (e.g., Moll, Amanti, Neff, & Gonzalez, 1992) where teachers visited students' homes to undertake observations of the funds of knowledge in everyday activities. Additionally, mathematics study groups were formed with parents, teachers, and researchers working together to examine the mathematics in household practices such as sewing (Gonzalez, Andrade, Civil, & Moll, 2001). A key finding of these studies was that mathematics education needs to move beyond a simple dichotomy – community

DOI: https://doi.org/10.26686/nzaroe.v26.6930

knowledge versus academic knowledge – and create mathematics classrooms in which we transform the funds of knowledge related to household or community activities into meaningful activities.

More recent research studies have involved pre-service teachers (PSTs) engaging in activities to develop their understanding of children's home and community experiences and knowledge related to mathematics. For example, in the study by Aguirre et al., (2013) PSTs made multiple visits to community locations sometimes with community members or parents as guides. Following these visits, they designed a problem-solving lesson drawing upon what they had learnt. A key finding was PSTs need increased opportunities to make meaningful connections to the funds of knowledge of students and how to use these as a resource for mathematical learning. Findings from other studies (e.g., Andrews, Yee, Greenhough, Hughes, & Winter, 2005; Nicol & Crespo, 2006) indicate that teachers have limited insights into the home and community activities related to mathematics that children are involved in. Similarly, during mathematics lessons only superficial connections to children's lives (for example, changing a name or context in the problem) were made unless teachers had specific opportunities to learn how to draw on student funds of knowledge. Given the strong focus in New Zealand in developing localised curriculum, we are interested in both how teachers positioned children's home and community knowledge in relation to mathematics and the resources they drew upon and tasks they used to develop localised curriculum prior to our intervention beginning.

Methodology

This article reports on a case study of eight teachers from one school and is part of a larger intervention study with two key objectives. Firstly, the study aims to provide ways in which to document and value the mathematical funds of knowledge of Pasifika communities. The second aim is to explore how teachers can successfully draw upon culturally embedded ways of knowing of Pāsifika learners in the mathematics classroom. The teachers taught from Year 1 to Year 6 at a low socio-economic, culturally diverse, urban school in New Zealand. They had between two years to 18 years of teaching experience and were from a range of ethnicities including Samoan, Fijian Indian, Chinese, and Pākehā. All of the teachers volunteered to participate in the study following an invitation from the research team.

To explore the teachers' initial perspectives individual interviews were undertaken at the beginning of the project. The interview consisted of seven questions focused on the teachers' perspectives of mathematics, task design, and their understanding of students' home backgrounds and cultural contexts. Interviews were audio-recorded and wholly transcribed. The results reported in this paper draw on three of the interview questions:

1) Do you think it's important to consider home culture or background when teaching maths? Why or why not?

2) What strategies do you use to find out about students' home contexts or cultural backgrounds to design tasks?

3) What contexts do you use in designing mathematical tasks?

Data analysis used a collective grounded approach in which the responses to each question were analysed individually in the first instance. This involved all the members of

DOI: https://doi.org/10.26686/nzaroe.v26.6930

the research team (authors of this article) reading the transcribed interview responses, reflecting upon these, and collaboratively developing codes and categories. Following this, the overall themes and patterns were for each interview question and across the set of interview questions. For example, in relation to consideration of home culture when teaching mathematics, this aligned with an overall theme of using 'real and relevant contexts' with sub categories including personal familiarity; engagement and motivation; and inauthenticity. The coding system was utilised to determine how to examine, cluster, and integrate the emerging themes (Creswell, 2008). To ensure reliability, the members of the research team engaged in discussion when there were contradictions and differences in relation to the appropriate codes until consensus was reached. Insights from the teacher interviews are presented in the next section.

Findings

Each section in the findings will provide an overview of the themes identified from the initial interview to the specific questions.

The importance of considering home culture or background when teaching mathematics

All of the teachers stated a view that it was important to consider the home culture and background of students when teaching mathematics. In general, the teachers aligned the importance of this with references to the context of mathematical tasks that were used during lessons. Most commonly, the teachers (n=6/8) referred to the importance of needing to consider home culture and background to ensure the use of real and relevant contexts when designing mathematical tasks. This was framed by a belief that students needed to be personally familiar with a context before this could be used in the task: *I'm a pretty strong believer in making it relevant, so there's no point talking about, I don't know waka or something if they've never experienced that. I mean it's great to bring in those cultural aspects but, I think if it's not relevant to them, and if they don't understand the context, then how are they meant to ever do anything with that*. Similarly, another teacher stated her perspective: *if you're presenting a problem that's completely a Pākehā sort of context, or completely a Samoan context, or whatever culture, if the person can't connect with what the information is in the problem, then how are they going to solve the problem?* Arguably, the perspective that it is necessary for *all* students in culturally diverse classrooms to be personally familiar with the context before it is used in a task potentially limits the range of contexts that could be used. Furthermore, as waka are commonly represented as a cultural metaphor when exploring the obligations of the Treaty of Waitangi as our founding document, then if this is an unknown context there is scope for this to be a context for valuable new learning and cultural understanding.

A number of teacher responses (n=3/8) referred to the importance of considering home culture to ensure that tasks drew on relevant contexts so as to engage and motivate. For example, one teacher stated: *If I talk about things like that, they will take interest, "oh she's talking about my culture, she's talking about food that we like."* One teacher noted the importance of actively supporting students to view mathematics as useful beyond schooling: *Make it relevant to their culture and their own experiences and they go "oh yeah I actually do that already" or "I understand why I might need to know that."* This teacher viewed the potential of connections between students' funds of knowledge and mathematical tasks as a means to strengthen students' understanding of the utility of mathematics.

DOI: https://doi.org/10.26686/nzaroe.v26.6930

One teacher from a Samoan background took a critical perspective in considering tasks that she had seen in curriculum material drawing on 'real-life' contexts: *Sometimes they'd have Hemi or you know those kind of names, but you know, OK you've just changed the name, Hemi wouldn't do this, you know.* In this reflection, the teacher highlighted the potential for the use of contexts in mathematics tasks to be tokenistic and disconnected from the authentic activities of diverse students. The teacher described a need to genuinely know your students when drawing on contexts related to the local community. She described an incident where she had designed a task related to waka coming into the Manukau Harbour without realising that a student in her class had had members of their family die in a boating accident in the Manukau Harbour.

What resources or strategies do teachers use to find out about home or community activities that students participate in related to mathematics?

In these initial interviews, the teachers referred to a range of strategies that they used to find out about home or community activities of their students linked to mathematics. At the centre of these activities was the idea that students themselves as well as their parents were a valuable source of information. All of the teachers described school-based activities that they used to find out information about home and community activities of the students. At the beginning of the year, the school held a day for parents and families to meet with the classroom teacher. Seven of the eight teachers identified this as a key way in which they developed their knowledge of the students' home context and activities. For example, one teacher stated: *at this school we have whanaungatanga day, which is where they come in and it's about getting to know you, it's about who lives in your family, you know if it's co-parenting, where they live, what the kids do, what sports they do and what the families value.* This was also identified by the teachers as a key way of beginning to build relationships with parents and families.

Teachers referred to using both structured and unstructured opportunities to develop knowledge of children's interests and out-of-school knowledge. For some teachers (n=4/8) the use of classroom activities was seen as useful. This included writing activities and oral language activities: *at the end of the day, we'll often do a five minute korero … and then you find out different things that the kids have been doing.* In addition, teachers (n=3/8) also referred to using unstructured activities. These included observations of children's play in the classroom and initiating conversations with them during break times both in the classroom and while on playground duty. One teacher referred to drawing on out-of-school opportunities such as going to watch students from her class play sports on the weekend.

What contexts did teachers use in designing mathematical tasks?

All of the teachers described a range of contexts that they draw upon when designing mathematical tasks. Most commonly, the teachers (n=7/8) described using school-based contexts. These were contexts that were based around the local school environment (playground, swimming pool), or focused on school events including celebrations or language weeks. For example, one teacher described: *we did swimming because that's really relevant to us at the moment because we're swimming at the moment, so yeah how many kids are in the pool, out of the pool.* A central issue to consider here is whether the use of school-based contexts is developing a localised curriculum that genuinely connects to students' funds of knowledge and funds of identity.

DOI: https://doi.org/10.26686/nzaroe.v26.6930

Many of the teachers (n=5/8) also described the use of out-of-school contexts when developing mathematical tasks. These largely encompassed generic contexts such as shopping, cooking, or sports and the links to mathematics were frequently at a surface level. For example, one teacher described using sports such as netball and league games as a context and developing problems focused on the number of teams and multiplication. Similarly, other teachers described problems focused on shopping at the market and adding or subtracting money. Three of the teachers described specific examples of student interests that they drew upon in the classroom. One of these included BMX bike riding while the other two drew on contexts linked to popular culture including Pokémon and video games. However, the links to mathematics while drawing on these contexts remained superficial, for example, counting the Pokémon cards.

Discussion and conclusion

The findings indicate the ongoing development that is required to support teachers to develop connections between the funds of knowledge and identity of diverse students and mathematics teaching within schooling. A key theme that was evident in these interviews was the perception from many of the teachers that students could only engage in mathematical tasks and be successful in solving these if they had direct experience and knowledge of the context. We conjecture that this may relate to the reliance reflected in their interview responses by these teachers on school-based or generic out-of-school contexts for mathematical tasks. In this case, the teachers perceived that access to mathematical learning while using contextual tasks could only be achieved by the use of shared contexts and therefore school was viewed as a shared site. Similarly, generic contexts such as shopping or working with money were also viewed as shared common activities. In contrast, we argue that there needs to be consideration of how contextual tasks aligned with different students' funds of knowledge and identity can be launched in ways that support all students to make sense of unfamiliar contexts and mathematical concepts. Given the high levels of diversity across many schools in New Zealand, this would provide opportunities to broaden the connections that could be made to home and community funds of knowledge for a diverse range of students. It would also allow students to access a range of worldviews and consider experiences beyond their own.

In parallel with the findings from earlier studies (e.g., Andrews et al., 2005; Gonzalez et al., 2001), we found that it was challenging for the teachers to recognise the mathematics embedded in the students' lives, including within cultural contexts, and in home and community activities. The teachers were able to draw on a range of sources of information including children themselves and their families through different activities. However, it is worth critically considering the extent to which teachers can develop deep understanding of the mathematics in household practices through these sources. One challenge itself may be that parents and caregivers do not explicitly recognise the mathematics that is used in everyday activities. Gonzalez et al. (2001) identified the challenges for educators themselves in recognising the mathematics in everyday activities such as sewing unless the processes involved in these were experientially real to the educator. Seminal research (e.g., Moll, 2014; Moll et al., 1992) into the funds of knowledge of diverse communities involved home visits by educators to both broaden and deepen their understanding of family contexts and links across curriculum strands. Recently, some studies (e.g., Esteban-Guitart, 2012; Mills et al., 2019) have positioned students themselves to document funds of knowledge and identity through drawing, photography, and interviews. More research is needed to further examine ways in which

DOI: https://doi.org/10.26686/nzaroe.v26.6930

students, families, and educators can be positioned to recognise mathematics related to funds of knowledge.

It was evident from the interview data that all of the teachers were using contextual tasks; however, it appeared that many of these tasks potentially had superficial connections to the students' lives. This is similar to the findings of Nicol and Crespo (2006) in relation to PSTs use of contextual tasks. Additionally, it appeared that the mathematics itself which was used in the tasks was linked in a superficial way rather than genuinely connecting to how mathematics is used in the home or community activities. These findings highlight that although in New Zealand we have had a policy shift to focus on the development of localised curriculum (Trinick & Heaton, 2020), teachers require support to learn how to recognise the mathematical funds of knowledge of diverse students and to develop authentic contextual tasks which provide deep links to this. Future areas of research need to focus on the type of targeted support and activities that extend teachers' understanding of the funds of knowledge of diverse groups of students and help them to develop an authentic localised mathematics curriculum.

A key limitation of the data reported in the article is that it only drew on self-reported interview data from the teachers. Future work to link the teacher interview data with student interview data and classroom observations will support a deeper investigation into this area.

References

Aguirre J. M., Turner E. E., Bartell, T. G., Kalinec-Craig, C., Foote, M. Q., McDuffie, A. R., & Drake, C. (2013). Making connections in practice: How prospective elementary teachers connect to children's mathematical thinking and community funds of knowledge in mathematics instruction. *Journal of Teacher Education*, *64*(2), 178-192.

Andrews, J., Yee, W. C., Greenhough, P., Hughes, M., & Winter, J. (2005). Teachers' funds of knowledge and the teaching and learning of mathematics in multi-ethnic primary schools: Two teachers' views of linking home and school. *Zentralblatt für Didaktik der Mathematik, 37***,** 72–80.

Civil, M. (2016). STEM learning research through a funds of knowledge lens. *Cultural Studies of Science Education, 11*(1), 41-59.

Dickie, J. (2011). Samoan students documenting their out-of-school literacies: An insider view of conflicting values. *Australian Journal of Language and Literacy, 34* (3), 247-259.

González, N., Andrade, R., Civil, M., & Moll, L. (2001). Bridging funds of distributed knowledge: Creating zones of practices in mathematics, *Journal of Education for Students Placed At Risk, 6*(1-2), 115-132.

Hogg, L. (2011). Funds of knowledge: An investigation of coherence within the literature. *Teaching and Teacher Education, 27*(4), 666-677.

Hunter, R., & Hunter, J. (2018). Maintaining a cultural identity while constructing a mathematical disposition as a Pāsifika learner. In E. A. McKinley & L. Tuhiwai Smith (Eds.), *Handbook of Indigenous Education*. Springer.

Mills, K., Bonsignore, E., Cleggetal, T., Ahn, J., Yip, J., Pauw, D., Cabrera, L., & Hernly, K., (2019). Connecting children's scientific funds of knowledge shared on social media to science concepts. *International Journal of Child Computer Interaction, 19,* 54-64.

Moll, L. (2014). *L. S. Vygotsky and Education*. Routledge.

Moll, L., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms*. Theory Into Practice, 31*(2), 132-141.

Nicol, C. C., & Crespo, S. M. (2006). Learning to teach with mathematics textbooks: How preservice teachers interpret and use curriculum materials. *Educational Studies in Mathematics, 62*(3), 331-355.

Si'ilata, R., Samu, T. W., & Siteine, A. (2018). The Va'atele framework: Redefining and transforming Pasifika education. In E. A. McKinley & L. T. Smith (Eds.), *Handbook of Indigenous Education.* Springer.

Stahl, G., Scholes, L., McDonald, S., & Lunn, J. (2021). Middle years students' engagement with science in rural and urban communities in Australia: Exploring science capital, place-based knowledges and familial relationships. *Pedagogy, Culture & Society, 29*(1),43-60.

Takeuchi, M. A. (2018). Conversions for life: Transnational families' mathematical funds of knowledge. In T. G. Bartell (ed.), *Toward Equity and Social Justice in Mathematics Education* (pp. 127 – 143). Springer.

Trinick, T., & Heaton, S. (2020). Curriculum for minority Indigenous communities: Social justice challenges. *Language, Culture and Curriculum.* Advance online publication. https://doi.org/10.1080/07908318.2020.1831009

Turner, H., Rubie-Davies, C. M., & Webber, M. (2015). Teacher expectations, ethnicity and the achievement Gap. *New Zealand Journal of Educational Studies, 50* (1), 55-69.

Williams, J. J., Tunks, J., Gonzalez-Carriedo, R., Faulkenberry, E., & Middlemiss, W. (2020). Supporting mathematics understanding through funds of knowledge. *Urban Education, 55*(3), 476-502.

Dr Jodie Hunter is an Associate Professor in mathematics education at the Institute of Education at Massey University, New Zealand. Previously she was a Research Fellow and Lecturer at the University of Plymouth. Her research interests include mathematics education for equity and social justice, early algebra, and culturally sustaining pedagogy. She is currently a Rutherford Discovery Fellow and has previously been a Fulbright fellow.

Email: J.Hunter1@massey.ac.nz

ORCiD: https://orcid.org/0000-0001-5463-3709

DOI: https://doi.org/10.26686/nzaroe.v26.6930

Roberta Hunter is a Professor of Pāsifika Education Studies in the Institute of Education at Massey University in New Zealand. Her research explores ambitious teaching; mathematical practices; communication and participation; and strength based and culturally sustaining practices in mathematics classrooms. Her most recent research has examined the mathematical practices students use as they work on problems embedded in social justice contexts.

Email: r.hunter@massey.ac.nz

ORCiD: https://orcid.org/0000-0002-9136-1551

John Tupouniua is a Lecturer in Mathematics Education at the Institute of Education, Massey University in New Zealand. His current research works towards enhancing Māori and Pasifika students' achievement in mathematics, as part of the Developing Mathematical Inquiry Communities (DMIC) initiative. John's other research interests include: analyzing advanced mathematical thinking and teaching and learning discrete mathematics (more specifically, the algorithmatizing approach).

Email: J.G.Tupouniua@massey.ac.nz

ORCiD: https://orcid.org/0000-0001-6541-4229

Louise Fitzgerald is a lecturer in mathematics education and initial teacher education at the Institute of Education at Massey University, New Zealand. Her research interests include mathematics education for equity, ambitious mathematics pedagogy, and culturally sustaining pedagogy.

Email: L.J.Fitzgerald@massey.ac.nz

ORCiD: https://orcid.org/0000-0001-7289-3803