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Creating opportunities to learn mathematics through the cultural framing of communication and participation patterns

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Access to opportunities to learn mathematics requires teaching that is responsive to the cultures of our students. New Zealand is home to the largest Pāsifika population in the Western world. Pāsifika is a homogeneous label for multi-ethnic groups of indigenous people from Pacific Island nations who have differing cultural values and experiences than the dominant European population. This paper highlights how opportunities to learn were created through the cultural framing of communication and participation patterns. Data were drawn from one class of 8–9-year-old students. Results indicate that when deliberate and specific consideration of the cultural values of diverse students are attended to, all students can be provided with equitable access and opportunities to learn.

Keywords: Diversity, culture, status, elementary school mathematics.

Introduction and background

Providing all students with opportunities to learn mathematics in relevant and meaningful ways offers significant potential for deep mathematical understanding. Access and opportunity to learn are possible when students reason together on mathematical activity. For students to collaborate effectively, teachers are required to develop and maintain specific communication and participation patterns (Bartell et al., 2017; Gutiérrez, 2012). For these participatory norms to be equitable, consideration should be given to the lived experiences and cultural backgrounds that all students, including those, who are increasingly marginalised in education, bring to school. The focus of this paper is to illustrate how diverse learners, specifically Pāsifika students, can be supported to participate in collective mathematical discussion. The question we investigated was: How can teachers create equitable communication and participation patterns for Pāsifika students in diverse mathematics classrooms?

Cultural connectedness and mathematics teaching and learning

Culture is a social structure that exists and is learned within local contexts where people interact with each other (Fecho & Clifton, 2017). New Zealand is home to an important group of peoples deeply connected to island nations in the South Pacific, including, Samoa, Tonga, Cook Islands, Niue, Tokelau, Tuvalu, Fiji, Kiribati, the Solomon Islands, and French Polynesia. Pāsifika peoples share many common values, including reciprocity, respect, service, inclusion, relationships, spirituality, leadership, love, and belonging. Above all, family, communitarianism, and collective responsibility are central to daily life (Ministry for Pacific Peoples, 2018).

Collectivism and communitarianism in the classroom context refer to ways of working together, such as, engaging in respectful group discussion, helping one another, and being of service (Ministry for Pacific Peoples, 2018). Working together to develop important ways of knowing and using

mathematics is widely acknowledged as an asset-based pedagogical approach with potential to build on all students' capabilities to engage meaningfully in learning mathematics (Esmonde & Langer-Osuna, 2013; Wood et al., 2019). When teachers expect all students to engage in collective mathematics activity, attention should be given to the beliefs and prior experiences diverse students bring to expected ways of participating and communicating (Civil et al., 2019; J. Hunter et al., 2020). Framing teaching and learning within the lived experiences and frames of reference of students situates learning within a culturally responsive approach (Gay, 2010). Within the New Zealand context, cultural responsiveness is understood to be grounded in the cultural relationships and responses to the prior knowledge and experiences of the students (Berryman et al., 2018). Furthermore, enacting culturally responsive teaching aligning with students' core cultural values meets the goals of equity in mathematics education.

Enacting culturally responsive teaching requires willingness for some teachers to change their practice when they realise that what they are doing is not working for all students. This call for change has been highlighted in Spiller's (2012) exploration of the complex nature of classroom interactions across a range of diverse cultures. Spiller's New Zealand study involved classroom observations of a range of Pāsifika students aged 13 years old from a low socio-economic school and teacher interviews. Many of the teachers in Spiller's investigation espoused the importance of engaging students in learning by providing opportunities for groupwork and classroom discussions. However, despite knowing that these opportunities would encourage student engagement, these teachers did not adapt their practice to support this way of learning. A range of reasons was offered, and Spiller outlined how these stemmed from teachers' deficit assumptions and beliefs about Pāsifika culture. These included apportioning blame to important Pāsifika values. For example, some teachers asserted that poor behaviour or lack of engagement were caused by Pāsifika values themselves and that disengagement in class was linked to Pāsifika children not being involved in decision making at home. Other teachers linked lack of "trying" to the Pāsifika value of humility, claiming that Pāsifika students did not want to look smart in front of their peers, so were reticent in participating in classroom discussions. Spiller highlighted that the best ways of learning for Pāsifika people reflects best practice for all students. Her analyses of Pāsifika students' voices strongly emphasised that these students' academic outcomes were greater in learning environments where teachers responded in culturally authentic ways to how these students learn best.

Internationally, the importance of drawing on the core cultural values of a range of diverse students in teaching and learning has also been recognised. Civil and Hunter (2015) reported on research undertaken by Civil in the U.S.A. (Arizona) with students (aged 12 years old) of Hispanic heritage. Civil worked alongside the teachers to support student participation in mathematical discussions. To accomplish this, Civil purposefully drew on these students' core cultural values of "familia" (Family), "confianza" (mutual trust), and relationships. Consequently, firm relationships with the students and their families were formed both in the school setting and in the community, resulting in students feeling included and able to engage in rich mathematical discourse. These kinds of learning environments where teachers enact culturally responsive and sustaining practices that strive to meet the goals of equity in mathematics education reflect a sociocultural perspective.

The theoretical framing of this paper lies within a socio-cultural perspective. In this view, individuals participate in everyday activities within a community of practice and learn to participate in ways valued by the community (Lave & Wenger, 1991). Through participation, a sense of belonging within the community develops.

Research design

This research reports on a case study of one classroom and forms part of a larger year-long design-based research study focused on equity in mathematics education. The participants were one teacher, of European descent (Alisi-a pseudonym) and 24 students (aged 8-9 years old) at a low socio-economic urban school in New Zealand. The rationale for participant selection was based on the diversity of the class, which included a high proportion of students identifying as Pāsifika (70%). Within the case classroom, mathematics lessons were characterised by students working in heterogeneous groups on challenging, contextualised mathematical tasks. The data reported on in this paper were drawn from video-recorded classroom observations and recorded teacher and student interviews over the duration of one school term (10 weeks). The recorded mathematics lessons provided opportunities for the researchers to capture the complexity of classroom systems and the means for micro-analysis of classroom episodes. Written student interviews were utilised. The aim of the written interviews was to capture the students' perspectives about what it means to be good at mathematics and how they felt about working collaboratively on mathematical activity. The teacher interviews were semi-structured, and a set of questions was used as a guide. Utilising this type of interview positioned the teacher as the experiential expert in the captured classroom episodes (Smith & Osborn, 2015). All recorded data were wholly transcribed. Data analysis used a grounded approach in which codes, categories, and themes were established. Initial examination of the data yielded the primary code (parent node) of social structures. The sub-nodes of teacher expectations, attending to culture, and student collaboration were developed through iterative and both individual and collegial analysis. To guarantee reliability of findings, the interview data were coded individually and then verified for analysis. Ongoing discussion of the findings followed until agreement was reached. The findings are presented in the following section.

Findings and discussion

The findings are presented chronologically providing a narrative of how the teacher (Alisi) attempted to establish effective participatory norms in class and the subsequent challenges that arose. Student interview data are also used to provide student perspectives and possible reasons for the emerging challenges.

Initial perspectives about teaching and learning mathematics

In interview at the beginning of the study, Alisi emphasised the importance of students learning mathematics through engagement in mathematical discourse while working on collective mathematical activity. She described her role as modelling expected behaviours and patterns of learning to create an environment where students drew on taken-as-accepted norms to reason collectively about mathematics. However, initial classroom observations and teacher-researcher discussions (during the first three weeks of the study) highlighted that these elements were not evident

in her mathematics lessons. In interview, Alisi acknowledged that unlike previous classes she had taught, she had encountered challenges in implementing and embedding effective participatory norms with her current cohort. She stated that she usually selected the norm she felt the students needed to develop. However, she acknowledged that while she chose the focus at the start of each lesson, she would routinely forget to hold the students accountable for enacting the particular focus throughout the lesson. Despite many attempts to provide opportunities for her students to develop effective participatory practices, she conceded she was struggling to establish and maintain these. The following extract highlights her thoughts:

Alisi: My students know the norms, they can rattle them off, but they don't know how to do them. Some of them just won't talk, and those that do just repeat whatever someone else has said without really understanding or thinking about it. I think they are just saying anything because they know I am expecting them to talk.

Alisi had noticed that her students knew what to do but were unsure how to enact these expectations. Reviewed classroom footage also highlighted many occasions where four students who were not of Pāsifika heritage dominated classroom discussions. In these instances, whenever Alisi extended an invitation to all students to participate in mathematical discussions, these four students would talk loudly over their peers, offer opinions, and reject others' statements. The more they dominated, the less the others contributed. Alisi described the four students as loud and self-confident, stating they would either shout out the answers very fast or believed only their ideas were valid and would not give other students opportunities to share their ideas. Status hierarchies had developed whereby these students had assigned themselves high status in class and had also been assigned high status by the other students, who lacked the confidence to challenge any of their statements, opinions, or ideas. Analyses of Alisi's students' initial written interviews (completed at the start of the study) provided further insight. In interview, the students were asked to provide their perspectives on their individual mathematics capabilities and how they felt about working in groups on mathematical activity. All four high-status students stated their beliefs that they were good at mathematics. Their reasons centred on the following themes: speed and accuracy of calculation; attending private mathematics tuition; and completing practice homework sheets. Emphasised were their beliefs that support for learning mathematics came from places outside the school setting. None of these students responded positively to working in groups. Their reasons focused on their perceived abilities to learn mathematics and the inability of their peers to do so. Those they considered unable to learn mathematics were described as incompetent, silly, and unwilling to listen to their authority. None of the high-status students stated wanting assistance from peers. Additionally, one student emphasised that even the teacher was not needed for support in learning mathematics.

In contrast, the remaining 20 students, 17 of whom identified as Pāsifika, and 3 of whom identified as Māori, responded in a range of ways. Those who believed they were good at mathematics attributed this to knowing the correct answer, or the teacher praising their effort (n=6). Others described being good at mathematics in instances of receiving help (n=4). One student identified needing specific knowledge, such as times tables to be successful (n=1). Those students who perceived they were not good at mathematics stated that success was only possible if acceptable social behaviour, speed, and accuracy of calculations were evident, or if the teacher invited them to share their ideas with the class

(n=9). All students (n=20) credited success in mathematics to external influences. They emphasised their teacher's actions as a determining factor in their capabilities to learn mathematics. If she did not call on them, they perceived she did not consider them capable of learning mathematics successfully. Further insight was gained through investigation of the students' responses to questions about working collaboratively. Analysis highlighted how perceptions of others significantly affected participation. Those who liked working in groups (n=16) stated that collaboration was beneficial only when assistance could be received or offered by other group members who were friends or "nice". Fear, shyness, and inadequacy in speed of calculation were stated as reasons for those (n=4) not enjoying collaboration. The low-status students conceded they needed support but were unwilling to ask for or receive help from the high-status students, as they were not considered to be friends or willing to help. The narrative created by this group was one where the dominant (high-status) students knew the mathematics and others (low status) did not.

The status quo formed a formidable impediment to learning as inequitable relationships of authority and power among the students had developed. Participation in mathematics learning was clearly characterised by who was perceived as holding the "maths smarts" at a particular moment in time. Furthermore, certain students (those dominating the discussions) were consistently afforded higher status than their peers while other students were accorded lower status and were ignored. These issues impacted significantly on the teacher's efforts in creating an equitable mathematics learning environment. Disrupting these imbalances required utilising specific pedagogical approaches.

Recognising conflicting beliefs

Alisi reflected on who her students were and the cultural values and life experiences they brought to school. In discussion, she noted that 17 of her 24 students identified as Pāsifika. She reflected on why she believed considering the cultural backgrounds of her students was important:

Alisi: I have been thinking, how do our classroom expectations fit in with my students' cultural norms? Like in terms of within a cultural setting, my Pāsifika students are not supposed to talk out of turn, unless they have been asked to speak. I wonder how much is going on in their heads, like, I am supposed to do this here, but I am not allowed to do this at home, they want me to talk here, but at home I am not allowed to share my opinions because I am a child and that is not my role.

Alisi had identified a significant conflict. In mathematics lessons, she had set expectations for student participation as engagement in respectful, purposeful mathematical discourse, and questioning. Alisi now questioned whether her expectations aligned with the core cultural values and experiences of all her students. She specifically highlighted potential challenges for her Pāsifika students in enacting certain expectations: For example, from a school perspective a core value such as respect would be enacted by students listening to the teacher, complying with behaviours and expectations the teacher required and expected. However, as Spiller (2012) outlined in her study, for Pāsifika students, being respectful was enacted by not talking without being invited to; not looking directly at others, in particular, at older people while they were talking; not questioning what others say; but rather, remaining respectful and humble by being silent. While Pāsifika students form a diverse heterogeneous group, there is a set of cultural similarities within Pāsifika values which include respect, reciprocity, communalism, and collective responsibility (Anae et al., 2001). Furthermore, while not the focus of

this paper, these values are also common across Māori, the Indigenous people of New Zealand. Alisi acknowledged that her students were expected to enact certain values in specific ways at school but that these expectations might not be acceptable in their communities, homes, or families. In particular, she acknowledged the importance Pāsifika place on family, stating:

Alisi: I want to create a connection to what the children already know about-they know how to behave at home. I want to bring that into the classroom. The expectations in the family. To listen to each other with respect and to pay attention.

Alis had recognized that for many of her students, the concept of family would illustrate accepted ways of working together which could be developed in the classroom. Her critical reflection served as a significant catalyst for transforming her subsequent pedagogical actions.

Creating opportunities for learning

Alisi took immediate action to attend to the obstacles to learning. In class, she invited all the students to talk together, with her, about the challenges they faced. The following extract highlights key elements from this discussion:

Alisi: We need to work together. We have agreed that our groupwork us not working well. Too many are just sitting waiting to repeat stuff other people have said. Some of you are talking, but not in a respectful way, and other people don't have the confidence to share if they are being put down when they speak. We have to fix this together, otherwise we are going to keep struggling to get to the maths, we are going to miss out on the learning we could be getting to.

Alisi addressed the challenges for learning directly. Respect was specifically identified as a key component of productive discourse. She stressed that without respectful collaboration, barriers to mathematics learning would endure. Alis had highlighted important aspects of collectivism and communitarianism (e.g., working together in respectful group discussion, helping one another, and being of service) that many of her students could identify with. Moreover, by using the collective term, “we”, Alisi positioned herself as part of the learning community. Further discussion ensued and Alisi presented a possible solution, as highlighted below:

Alisi: We have to find a way of working together successfully. We need to think about how we could work together as a family.

Alisi deliberately stressed that they were a community of learners and drew attention to the core Pāsifika value of family as a metaphor for working together. By emphasising the importance of family, mutually understood ways of togetherness could be developed. Moreover, the value of respect for family members could be further drawn on to support effective student collaboration and establishing a sense of belonging to community (classroom learning). These actions support previous research (e.g., Spiller, 2012) which highlighted the importance Pāsifika people place on feeling a sense of belonging and purpose in all aspects of their daily lives, including at school. Like Civil and Hunter's (2015) study, together, Alisi and students identified and agreed on how working together as family could be enacted. Alisi maintained a focus on prosocial elements only. In class, over several sessions, together, she and the students continued developing and enacting values such as being respectful, belonging, kindness, listening, thinking, responding with respect, helping others, asking for help, being patient, showing love, and being humble. Specifically, Alisi drew on the Pāsifika

values of collectivism and communalism, working with the students to develop respectful ways of working together, and ways of supporting each other. These actions carefully scaffolded all students to shift from participation motivated by compliance or dominance to participation motivated by a set of commonly upheld values and beliefs. These outcomes support what J. Hunter et al. (2020) described as connecting core values and beliefs in culturally responsive ways, which in turn, strengthen positive social skills and support students in developing constructive and improved relationships, not only with mathematics, but with each other.

By purposefully using the metaphor of family, the teacher had provided access for all of the students to understand how to collaborate effectively. By carefully examining key components of the concept of family, several core Pāsifika values were identified that were relevant to all the students in class, regardless of cultural background. These deliberate actions support previous research (e.g., Hunter, 2013) concluding that equitable learning environments required careful consideration of the core cultural values that all students (and the teachers) bring to the classroom community. Alisi's actions in this report demonstrate how expectations for and models of communication and participation can be explicitly attended to in response to specific ways of knowing and being of the students from a cultural perspective. These findings illustrate the importance of attending to culture and provide a model for culturally responsive pedagogies as described in previous research (e.g., Berryman et al., 2018; Gay, 2010).

Conclusion

This paper illustrates how drawing on a cultural frame can support students to work together in respectful ways. Specifically, in this study, the teacher established clear expectations for effective participation and collaboration by identifying and utilising several important Pāsifika values, such as belonging, family, and collectivism. In doing so, she was able to create authentic and connected ways for students to learn together. Emphasizing and drawing on the cultural perspectives of Pāsifika students to frame expected behaviours for everyone (including the teacher) builds on the goals of equity in mathematics teaching and learning highlighted by other researchers both internationally and in New Zealand (Gutiérrez, 2012; J. Hunter et al., 2020). This research also expands further on the aims of equity by identifying how teachers can respond and adapt to students in culturally authentic ways, and in this manner, all students can be provided with what Spiller (2012, p. 65) termed “dignity in their learning”.

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