The Role of Cultural Capital in Creating Equity for Pāsifika Learners in Mathematics

Trevor Bills
Massey University
<t.d.bills@massey.ac.nz>

Roberta Hunter
Massey University
<r.hunter@massey.ac.nz>

Despite the Ministry of Education Statement of Intent 2014 – 2018 that the performance of the education system for priority students – Māori, Pāsifika, students with special education needs and students from low socio-economic areas needs to improve rapidly these groups remain a concern in the New Zealand Education System. This article explores what happens to a group of Pāsifika students and their teachers when the teachers draw on Pāsifika focused culturally responsive teaching in the mathematics classroom. Changes to the identity and mathematical disposition of the Pāsifika students are illustrated when their ethos becomes the cultural capital valued in the classroom using teacher and student voice.

Introduction

In New Zealand a disproportionate number of Pāsifika students perform below their European and Asian counterparts (New Zealand Qualifications Authority, 2013). In order to address significant disparities in numeracy and literacy achievement the Ministry of Education affords priority to this specific group of learners (Ministry of Education, 2014). The goal for priority Pāsifika learners is placed on ensuring high quality and inclusive teaching that incorporates aspects of the students' language, identity, and culture. Educationalists are charged with the responsibility to place them, their parents, fānau (families), and communities central to changes aimed to increase Pāsifika capability and competence. Central to the changes is the goal to draw on knowledge and understandings of Pāsifika culture and its use in Pāsifika focused pedagogy – a goal which may hold challenges for many teachers. Developing appropriate pedagogy situated within the known world of their Pāsifika students is difficult given that the cultural experiences of Pāsifika learners may be different in both obvious and subtle ways from those commonly experienced by many New Zealand teachers. This paper explores what happens when teachers explicitly explore ways they can engage with the language, culture, and identity of their Pāsifika students to structure the mathematical activity in the classroom. The key question we examined was: What is the effect on Pāsifika students' relationship with mathematics when teachers use Pāsifika focused culturally responsive pedagogy?

Literature Review

Pāsifika students enter New Zealand schools with a rich background of experiences. However, the lived reality in the school life of many of them can be significantly different from their home life experiences. As a result researchers (e.g., Anae, Coxon, Mara, Wendt-Samu, & Finau, 2001; Barton, 1995; Hunter & Anthony, 2011) argue that this is a contributing factor in their underachievement and disengagement with their New Zealand schooling. As Bartolomé (1996) explains, unless educational methods are situated in students' cultural world they will continue to show difficulty in mastering content area. This is because the learning is not only alien to their reality, but may also be antagonistic to their culture and lived experiences – that is their cultural capital. The term cultural capital used by Bourdieu and Passeron (1973) is defined by McLaren (1994) as being the general

2015. In M. Marshman, V. Geiger, & A. Bennison (Eds.). *Mathematics education in the margins* (Proceedings of the 38th annual conference of the Mathematics Education Research Group of Australasia), pp. 109–116. Sunshine Coast: MERGA.

cultural background, knowledge, disposition, and skills that are passed on from one generation to another. Cultural capital represents "ways of talking, acting, and socialising, as well as language practices, values, and types of dress and behaviour" (McLaren, 1994, p. 219).

The cultural capital valued in many New Zealand mathematics classrooms reflects the cultural capital of the dominant New Zealand cultural groups. For example in recent professional development reforms (Ministry of Education, 2004), the grouping system promoted and used in most mathematics classrooms drew on the dominant group of Western origins beliefs and values. The use of streamed groups encouraged competitiveness and placed importance on individual success. An emphasis on the individual in the NZ Numeracy project contrasts directly with Pāsifika notions of the value of collectivism. Within a Pāsifika view the success of group members is measured by the success of the collective as a whole. This may well suggest a reason for why Pāsifika students were not as successful in this project as the Asian and European cohort. However, recent New Zealand studies (Hunter, 2013; Hunter & Anthony, 2011) illustrate that when teachers draw on the cultural background of their Pāsifika students and use them to shape the interactions in the mathematics classroom both their mathematical achievement results and engagement in communicating their mathematical reasoning increase. These studies provide persuasive evidence that when teachers draw on the cultural context and values of their Pāsifika students and use them to engage and connect them to mathematics their mathematical learning is accelerated and their mathematical disposition enhanced.

To engage and connect Pāsifika students to mathematics not only do teachers need to consider the cultural context and values of the students they also need to take into account Pāsifika languages, culture and identity. This is in line with the seminal work of Paulo Freire (2000). He argues the need for education to transform oppressive structures by engaging people who have been marginalized and dehumanized and drawing on what they already know. Other researchers (e.g., Frankenstein, 2010; Stinson, Bidwell, & Powell, 2012) building on this epistemology through ethnomathematics argue the need for educators to learn about how cultural practices – daily practice, language, power, and ideology constitute people's views of mathematics and their ways of thinking mathematically. Moreover, Freire (2000) emphasises the importance of dialogical education built on respect with people working together in reciprocal relationships. Freire (2000) argues the importance of egalitarian dialogue, based on the validity of the argument and not on power imbalances in the teacher and student relationship. He also contends that praxis or informed action embedded in values is also important as is situating the educational activity in the lived experience of the learners. This is illustrated in Boaler's (2002) study which showed that in classrooms where teachers hold the balance of control over which methods and procedures are used students have less opportunity to interact with the mathematics. They also perceived that they were secondary to the teacher and became passive recipients of knowledge. In contrast in classrooms where power was more evenly distributed students developed positive dispositions which led to deeper mathematical understandings.

In a recent MERGA paper, Jorgensen (2014) presented a challenge to mathematics researchers. She argued that a new paradigm in mathematics education was needed because despite the many social theories of learning there remains a "significant problem with the outcomes in indigenous education in particular and equity target groups in general" (p. 311). She questions whether the inequitable outcomes may be structural and not something random. She suggests that schools and education are structured in ways that

reproduce inequality. In response, this paper draws on a critical pedagogical lens in order to understand what the relationship is between learning and social change (Giroux, 1983). Giroux (1983) explains that within this frame, students are listened to and provided with a voice and role in their own learning. In turn, teachers not only educate students but also learn from them in a reciprocal relationship. As such critical pedagogy is a humanizing pedagogy that values students' (and teachers') background knowledge, culture, and lived experiences (Bartolomé, 1996).

Methodology

This research is part of a large project which involves 240 teachers in twenty New Zealand urban full primary schools. The students come from very low socio-economic home environments and are of predominantly Pācific Nations groupings. Many of them speak English as a second language and some are new immigrants with little English. The project looks at changing the cultural capital of the mathematics classroom so that it better matches that of Pāsifika students. Complex and challenging mathematics problems are devised around aspects of Pāsifika culture and the students' daily lives.

Core Pāsifika values are explicitly used to underpin the social and sociomathematical norms constructed within the mathematical inquiry community. These values include reciprocity, respect, service, inclusion, family, relationships, spirituality, leadership, collectivism, love, and belonging. The students are placed in mixed ability groups which runs counter to common New Zealand practices and the Pāsifika concept of collectivism is used to structure small group activity. This builds on the notion of success of the group as a collective, rather than as individual members in the group. Another example of the use of Pāsifika values is the use of reciprocity and service. The students are structured to be responsible to ask and respond to questions and use mathematical argumentation in ways considered respectful as a Pāsifika person.

In this project students were also encouraged and supported in using their first language when discussing, explaining and justifying their mathematical understandings. This recognised that Pāsifika students often have to deal with various language difficulties when learning mathematics including at times their first language not having an equivalent word for the concept that they are learning about. In addition, in order to achieve success in mathematics the students need to be able to read and understand the mathematical problems set for them. This can prove difficult for Pāsifika students who do not have English as their first language. During the course of the research these issues were minimised by encouraging the students to switch between their first language and English in order to develop deeper understandings. One of the Samoan teachers also regularly switched from English to Samoan to help individual students clarify the problems and to get them to explain their reasoning.

In contrast, prior to involvement in the larger project the teachers taught according to the New Zealand Numeracy Project (Ministry of Education, 2004). The students experienced mathematical activity within ability groups and tasks were drawn from the Numeracy Project which was English language based and tends to better match the beliefs and values within the frame of the more dominant Western participants. This paper reports on three teachers (2 Pāsifika and 1 Māori) and their students who ranged in age from 10 – 12 years. Pseudonyms are used for the three teachers. In their previous mathematics teaching all three teachers described themselves as the disseminator of knowledge and the main power holder in the classroom.

For this paper only one section of the data was used. This involved a set of open ended questions which allowed for multiple responses. Analysis of the data consisted of comparing and contrasting responses from the different teachers and students. Emerging themes and patterns were determined and analysed.

Results and Discussion

The initial interview question explored how addressing the cultural identity and the core Pāsifika value of reciprocity changed how the students considered agency and power in the mathematical activity. In response Hone one of the classroom teachers explains:

> Hone: What I've noticed over the time I have been part of the programme is the importance of having the student voice as opposed to being teacher directed. When it's all teacher directed you can share till the cows come home but if it doesn't make sense to them it's not going to. If you give them a problem and say go away and have a look at that, come back to me, what do you think is happening? They start sharing their ideas and they feel valued because they are being listened to.

Student ownership of the mathematics had become shared within an expectation of mutual responsibility. In the changed roles students could be teachers while the teachers could learn from the students as Eti another teacher explains:

> Eti: There has been a shift in the percentage of student voice. The locus of control is not so much us, but what the students are discussing and sharing and that's really powerful seeing that shift from us having all the power to a shared power…and it's a shared responsibility and we become the facilitator and the students become teachers to each other and that's really good to see. Because there is more student voice and they have more control you can also see what the students know and how they think, they can explain their reasoning more. We can also learn more about them, like they come out with strategies to solve some of the problems that I haven't thought of and it's like…. yeah that works.

The students also described the way in which they now shared the responsibility for their own learning and the learning of others. They described how the power was shared between the teacher and students and how this changed the classroom mathematical talk. As the students explained:

> Sione: Yeah, It's not just one person answering the question; we get others' opinions so everyone understands. It's our responsibility as a team to work together. And it's good because you can talk to people. Before you just had your book and you got a growl if you talked or asked someone a question but now you can.
>
> Luana: In this maths we have more power. He (teacher) gives us the problem but the problem is about us …. our reality and we have to figure it out, we are responsible for our own learning and others' learning too, we have control.

A number of students also described how the teachers through listening to them learnt new ways of thinking mathematically. They also identified how the teachers were able to respond and progress their reasoning 'in the moment'. For example Siale stated:

> Siale: He can learn what we think and how to help us improve.

Clearly, within the more balanced power relationships what Freire (2000) described as dialogical education was evident. In these classrooms the mutual respect of all classroom members supported the development of reciprocal relationships.

The second interview question examined how integration of core Pāsifika values into the social and sociomathematical norms in the mathematical activity assisted the students

with their learning and identity. The teachers described metaphorically how they were a Pāsifika family and how this frame shaped the interactions:

> Hone: Family is big, it's everything. The way our classes are set up now everyone has a chance to share ideas, and like a family everyone helps out, and nobody is left out because everybody has a job to do and that's the Pāsifika way and the Māori way. We talk about that a lot as a class, like if you are doing the housework everybody helps or if you are making an umu or hangi (earth oven) everybody has a job to do. It might be dig the hole or peel the spuds but you have a job… and like with a vaka (canoe) everybody has got to paddle in the same direction, in time if you are going to move and the kids can relate to that because that's their world.

They described how respect shaped the way the students engaged in mathematical argumentation:

> Eti: Respect is a big part of being a family as well. Everyone shows respect because we are a family and they know they all have a say and have a chance to listen to what other people say and if things are not clear to them they can generate friendly arguments and say… hey where did you get that from because my understanding is this and everyone comes away with a broader understanding.

Taking risks with mathematical reasoning and making mistakes were presented as learning contexts within the context of the Pāsifika values:

> Sina: We talk about the value of respect and about accepting others, and that's really strong. We encourage them to participate and take a risk but it's safe because there is respect and inclusion and love so nobody is going to put you down if you get it wrong because we learn from our mistakes. We are all learners and we have the right to learn and the responsibility to listen to others because we are family.

The students also described how the different Pāsifika values shaped the way they engaged in mathematics. They described how respect for each other shaped how they engaged in mathematical argumentation:

> Sione: Respect is real important. When you have respect you can have friendly arguments and you argue about the maths so it's not nah you're wrong or you're dumb eh, it's like I don't agree with your maths and this is what I think or you have to convince me.
>
> Grace: You can have friendly debates about maths……and then you have to justify your answer. And then if you made a mistake you learn from your mistake.

Reciprocity and collectivism also shaped their interactions as they took responsibility for their own mathematical reasoning and the reasoning of others':

> Luana: It is not fair if you have the answer and nobody else knows what you are talking about. So you have to explain step by step to help them get to their answer so they understand and not just go I got an answer so…….You have to help each other figure it out. Everyone has to be included and contribute to the work. You have to encourage them to get their own answer though, not just give them the answer.
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> Josef: Respect is important because they may have an answer that's wrong, but don't judge them. If you don't show respect then how are we a team? How can we work together and take our ideas and put them together.

With the Pāsifika values incorporated into the ethos of the classroom there was no longer disconnect between the home life of the students and the school. Family, sharing and collectivism had become the cultural capital promoted in the classrooms rather than individualism and competition. Mutuality and respect were integral to the development of the mathematical inquiry community.

The next question explored how the use of problems which drew on the context of the students' every-day lives and were culturally relevant affected their learning. The teachers recognised how the different contexts lent themselves to learning across the mathematical strands. They also described how the students became more deeply engaged when the problems connected to their own reality:

> Eti: Things around family…even if you were talking about food….how many corned beef cans… you can also link the strands in…measurement, volume, capacity, how many plates will you need…and the students can relate to it. Cultural contexts might be looking at tapa patterns and the types of maths in the patterns and they get to share back their experience and they can compare what they call it; because in Samoa it's Siapo and Tonga it's Ngatu and Fiji it's called Masi because if you just said tapa lots of the kids wouldn't know what you were talking about but they have these discussions and they all have a concept of the patterns but they hadn't seen the maths in that. You can then pose a problem and if they have a grasp you have a foundation for the discussion and we can then expand the maths….it's not until they make those connections they realise the real life situations they are involved in like a hair cutting ceremony or making ula lole (lolly necklaces) that maths links in so when we highlight that they are like WOW, there is maths here. Until we started to bring these types of problems they didn't make those links and they saw maths as something they did at school that was not relevant. This has been one of the most powerful parts of the maths project. The biggest concept for our kids to know is maths is everywhere……it is not just for maths time. That's the hook in…. we practise that with our family… we practise this in our church and in our community so when they make those links and can tie it into…. well maths is everywhere. Maths is part of my culture… the value of maths changes and the idea that maths is hard or alien or random changes as well.

The teachers recognised how the problems connected the students' home and school mathematical lives. The students also affirmed the importance of the use of relevant contexts and seeing themselves in the mathematics problems:

> Josef: The maths is about us, about the community. The problems relate to our cultures and celebrations which makes it more understandable.
>
> Luana: It makes it easier for us to learn…like the ula lole (lolly necklace) problem because most of us have made it before and we can see it and have a picture in our minds so we can see how it's proportions and ratios like one chocolate to three fruit burst or minties.
>
> Grace: When the problems are about us you can see that maths is real and it's useful…...not just something random you do at school.

Importantly, not only did the problems connect their home and school mathematical life but it also normalised them as citizens within their own culture.

> Sione: When the maths is about us and our culture it makes me feel normal, and my culture is normal.
>
> Luana: Yeah like it is normal to be Samoan or Tongan.

The students were provided with opportunities to see mathematics in their 'lived life' while at the same time their 'lived life' was affirmed through ensuring that their cultural capital was reflected in both mathematics problems and activity.

The final question explored how the use of the first language of the different students supported them in engaging and learning mathematics. The teachers described how all class members supported each other:

> Sina: My ESOL girl had only been in the country for a week so some of my Samoan girls helped her by speaking Samoan to her. They would read the question to her in Samoan so she could understand and she is able to talk back to them and explain what she is doing. I am Samoan so I understand what they are saying as well but if they were Cook Island I would just get some of the Cook Islanders to talk in their language and translate for me or represent in a

different way so I would get them to draw it and I would understand what they are drawing so it doesn't matter what nationality they are. So it's just using different ways because she wasn't getting it but when they were able to switch and talk to her in her own language she was able to make connections and go okay now I know what they are talking about.

The teachers also described the use of different Pāsifika languages to deepen understanding and ensure that all members of the community could interact:

John: It's really powerful if they can use their own language because sometimes it might just be that they don't understand the question or even the ones that speak English there might not be a word in English that represents what they are talking about or they might be more confident speaking Samoan or Tongan and then others can translate. Without that, like in the past those kids didn't have a voice and you would just think they couldn't do it. It really helps transfer the power as well, as I don't always understand and they have to translate for me and their understanding really improves when they do this.

The students also realised the value of using different languages:

Sione: Sometimes it helps to explain things in Tongan because some of the Tongans in our class are new and their English isn't that good but they can understand the maths in Tongan which is cool because before you didn't really speak Tongan in class.

The encouragement of the use of students' first language in mathematical activity not only helped with deepening the conceptual understanding it also improved their self-esteem and disposition towards mathematics as language was no longer a barrier to success.

Conclusion and Implications

Jorgenson (2014) challenged the mathematics community to find other ways to address the inequitable outcomes which are evident when we look at who achieves in mathematics. This paper suggests some ways of beginning to address her challenge. The findings illustrate that when teachers do seriously consider the cultural capital of the students they carefully consider its influence in their teaching and so they begin to balance more equitable outcomes for their learners in mathematics. The lived reality of their students became what guided the ethos of the classroom. This supports Bartolomé's (1996) contention that when educational activity does not match the world of the learner they are precluded from achieving.

The responses from teachers and students reinforced what Hunter and Anthony (2011) had suggested regarding the importance of culturally relevant values when working with Pāsifika students. In this study evidence is provided of how students learnt how to interact with each other in respectful ways and appreciate the cultural differences. Issues of cultural differences and perceived abilities also lessened as the students began to perceive what their roles were as users and doers of mathematics. Boaler (2006) viewed this as gaining relational equity. Illustrated here in these findings is how she argued that students develop respect for different cultural groups when they are provided with opportunities to learn through culturally relevant examples and actions.

In the findings in this paper we have presented data that suggests not only a shift in identity but also a shift in mathematical disposition. Through culturally responsive teaching and the teachers' actions of drawing on the cultural capital of the students it allowed them access to the mathematical problems and also supported them to engage with each other mathematically in culturally appropriate ways. The teachers too were inducted into a world where they could develop a vision of culturally Pāsifika responsive actions which they could use in their mathematics teaching. Closely aligned was the way in which

the views of the students had shifted towards seeing mathematics as part of the world they inhabited and something they needed within that world.

Clearly evident in the findings of this paper is the way in which culture and language shape the identity of students. These Pāsifika learners were empowered by the actions of their teachers as they explicitly drew on and used the cultural capital of the students in ways that supported them as mathematical learners. The results were transformative in that not only did the teachers bridge the gaps maintained by what is taken as normal or status quo – they also were able to bridge the same gaps for their students and empower them as learners. The implications of this research link directly to the need for more research in this field. The problem society is creating in allowing groups of underachieving students to continue needs to be addressed. This study suggests that we do have some strategies which directly illustrate the effect of culturally responsive teaching but we need to explore this on a larger scale.

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