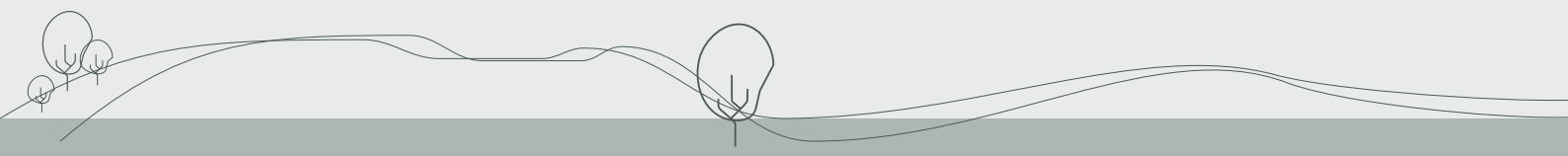


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Culturally responsive pedagogy and assessment in primary science classrooms: Whakamana tamariki

Introduction

In this project four teachers addressed their diverse students' need for a range of different opportunities to develop more sophisticated expertise in science. They achieved this by drawing on the principles and practices of culturally responsive pedagogy and assessment for learning. Interviews and classroom observations indicated that students, and their families, took greater ownership and responsibility for science learning when teachers incorporated and built on the funds of knowledge and lived experience that *all* students bring from their homes and communities.





Key findings

- Teachers can create culturally responsive pathways for science learning by incorporating children's and communities' funds of knowledge into the curriculum.
- Culturally responsive science teachers at times position themselves as learners so that students, and their families and whānau, can contribute their expertise.
- Culturally responsive science classrooms support diverse ways for children to develop, express and share a cumulative understanding of science.

Major implications

- Teaching and learning science will be enriched if teachers build bridges and create opportunities to connect the classroom curriculum with children's and communities' lived experiences beyond school.
- Teachers and students need to create an inclusive and respectful classroom culture that welcomes and responds to outside expertise to contribute to collective sense making in science.
- Learning and assessment in science need to provide and privilege diverse ways for children to express, develop and gain feedback on their growing knowledge and expertise.

The research

Background

Student participation and achievement in science is a social justice and equity issue because of the roles science and its applications play in addressing many of the challenges and exploring the opportunities facing society today (Ministry of Education, 2007). New Zealand primary classes increasingly include students with diverse cultural, linguistic and experiential backgrounds. For some of these children their home and cultural background, ways of interacting, and making sense of the world allow them to fit easily into school science. Others, although their knowledge and experience are just as rich, struggle to find a way to engage and participate in classroom science learning. This study examines the synergies between current understanding of culturally responsive pedagogy (Glynn, Cowie, Otrrel-Cass & Macfarlane, 2010) and assessment for learning (Cowie, Moreland, Jones, & Otrrel-Cass, 2008) in primary science classrooms.

Research questions

The following inter-related research questions guided the study:

1. What does it look, sound and feel like when teachers establish a culturally responsive learning environment

- in which students from diverse backgrounds, cultures and experiences can engage with science?
2. When culturally responsive pedagogies are employed in science learning, what are the possibilities and dilemmas that arise for students and teachers?
3. What strategies and resources enable students to demonstrate the breadth of their knowledge and understanding of science?

Methodology

The research team comprised four primary school teachers (the fourth teacher joined the study in the second year to replace one of the original teachers, who moved overseas) and four researchers. The teachers developed teaching units, one each year for 2 years, based on student interests and school curriculum requirements. Data were collected on teaching and learning in the classrooms using video, digital photographs, field notes, student surveys, the collection of student work, and student and teacher conversations. The team met regularly. These meetings served as opportunities for planning and collaborative reflection on data.

Data analysis proceeded through a process of thematic analysis informed by the key elements of culturally responsive pedagogy, which positions students and their communities as having funds of knowledge and expertise directly related to their lived experiences (Gonzalez, Moll & Amanti, 2005). A culturally responsive pedagogical orientation focuses attention on reciprocity in exchanging teacher and learner roles; on collective responsibility; and on the importance of caring and respectful classroom relationships between people, and between students' cultural knowledge and domain knowledge (Glynn, Cowie, & Otrrel-Cass & Macfarlane, 2010). Our interest in assessment for learning motivated a focus on the opportunities students have to express and construct meaning and to gain feedback on their ideas.

Findings

Students, families and whānau have funds of knowledge relevant to science.

The teachers found that when they invited students and their whānau to contribute their funds of knowledge and lived experiences from their homes and communities, the students were able to utilise this rich resource in their science learning. The funds of knowledge that were made available by children and their families included those based on everyday experiences with natural phenomena, cultural legends and family stories, as well as standard science explanations. Sharing this knowledge opened up new spaces where exploring and explaining natural phenomena was something that could be engaged in at school and by the community. Student engagement increased and learning was made more meaningful and equitable.



Illustrative examples

In Asri's class Taylor interviewed her uncle, who was a kaitiaki (guardian) for the local community, as part of a home learning task. The ideas about conservation that Taylor introduced became part of the classroom science curriculum. Similarly, Tommy reported that when he goes fishing with his whānau, the first fish caught has to be returned to the sea to thank Tangaroa, god of the sea, for his bounty.

It is important for teachers to invite in, share and incorporate student funds of knowledge into the curriculum

The teachers selected topics and activities that took account of student interest and community expertise, and that fitted with school events. They planned explicitly for students to engage with "big ideas" such as form and function, adaptation, and day and night.

Illustrative examples

Jude focused on space and the Matariki (Pleiades) constellation to link her class's science learning with the Matariki celebrations at the school. Asri used flounder as an example of adaptation because she knew some of her students and their families had been floundering and therefore would have ideas and experiences to contribute. Marion decided to focus on tuatara rather than the syndicate topic of dinosaurs when her children expressed interest in carvings of tuatara during a visit to a marae.

The teachers used an ensemble of strategies to welcome and highlight the value of community and student funds of knowledge. These strategies included reading and discussing cultural legends, teachers sharing their own out-of-school knowledge and experiences, and inviting in families and outside experts. Two of the teachers used home learning books as a tool for initiating home-based conversations about science and as a way to bring aspects of this conversation into the classroom. The home learning books served as a stimulus and source of empowerment in both settings. The books allowed teachers to establish and sustain a reciprocal relationship between students, teachers and families as learners of science.

Illustrative examples

Jude and her students invited parents to a meeting to explain the forthcoming unit topic of space and to introduce parents to home learning books as a new means of home-school communication. Family members appreciated hearing what their children were *going* to be learning and how their own experiences could be relevant. The students valued having their parents come to this meeting. Jude continued to involve families through the home learning books; constructing a class web page; holding a whānau/family night sky viewing under the guidance of two members of the local astronomy club; organising a talk from a Ngāti Ranginui celestial navigator of the Pacific; and holding a parent/whānau meeting to share and celebrate the students' learning journey and learning outcomes.

Teaching in a culturally responsive way involves power sharing—tuakana teina in action

Teachers seeking out, affirming and incorporating student and community funds of knowledge into the curriculum sometimes challenged traditional classroom power-knowledge relationships. When students and communities had greater knowledge, the classroom culture had to be such that students and teachers were comfortable with teachers positioning themselves as learners. The teachers were initially tentative about this, but they quickly realised their students were more than willing to support them. The teachers found it helpful to think of this responsive process as reflecting the principles and cultural responsibilities of ako (in this context, a responsive and reciprocal process, through which both teaching and learning roles are shared) and tuakana teina in action (the more informed and more skilled teaching the less-informed and less skilled).

Illustrative examples

Asri welcomed an offer by Tommy, a competent speaker of Māori, to read aloud to the class in Māori the *Legend of the Seven Whales* while she read the story in English. Tommy's expertise in te reo was acknowledged and drawn on frequently by Asri and Tommy's peers throughout the unit.

Christine shared the school science objectives with her students prior to negotiating with them the upcoming curriculum. Throughout the unit, Christine and her students continued to negotiate the specific focus. Within this process the students "stepped up and took ownership and leadership of their own learning". For example, they acted out skits about the relationships between major North Island volcanoes.



Four of Asri's older students supported Marion's new entrants to generate and record their questions about tuatara prior to visiting a tuatara sanctuary. After the visit, the older students reported they had learnt a lot about tuatara from the younger children. Asri's students themselves took on the tuakana role when they found they knew more than their families about jellyfish adaptation.

Assessment to make learning visible and move it forward

Ongoing assessment for learning is integral to teaching that is responsive to student ideas and expertise. All four teachers provided students with a range of opportunities to express and develop their knowledge and expertise. They used a variety of activities to elaborate on the big idea for a unit. Different modes (speaking, writing, drawing, dramatising, making), media, social arrangements and audiences provided students with a variety of different entry points into science learning and ways of displaying what they knew, and ways to gain feedback that did not rely solely on teacher authority.

Illustrative examples

Marion's new entrant class sketched tuatara based on photographs and on observations of tuatara in the wild. While visiting a local marae they touched the carvings and learnt about and discussed the cultural significance of a tuatara carved on a pou (carved post). After observing tuatara and hearing from an expert at a sanctuary, they acted out how tuatara move, wrote captions for photographs of tuatara and their habitat, constructed a diorama depicting a tuatara habitat and made a tuatara out of clay.

In Jude's class, students collected and interpreted data to enable them to deliver an accurate daily weather report over the school intercom. To perfect their presentation they practised in pairs and with an audience. Audio recording enabled them to self-review. They received positive feedback from peers and other teachers for their informative and polished presentations to the school. Their parents appreciated seeing how much their children knew from the video recordings presented during parent-teacher interviews.

Major implications

Teachers employing culturally responsive pedagogies in science need to demonstrate several key understandings and competencies. First, they need to affirm and respect the diversity of the knowledge and expertise of the families and communities of their students. Such teachers view diversity as fundamental to all human interaction and as a crucial source of creativity and insight. Affirming student and community expertise

reassures students and their families that there is a place for their lived experiences within the science classroom.

Teachers need to be seen out in the community by the students and families. A person who is visible in the community is more likely to be respected as having a commitment to, or investment in, the community (he kanohi kitea). From this important starting point teachers can explore ways to build bridges to encourage and enable their students to bring their funds of knowledge and expertise into the science classroom. A useful starting place is to build on successful activities. If something works, then it makes sense to extend it. Teachers then need to allocate time and plan for students to share this knowledge and to incorporate these funds of knowledge and expertise into the learning and teaching of science.

Reading about and discussing research on culturally responsive pedagogy and deepening their knowledge of the nature of science (Ministry of Education, 2007, p.28) can provide teachers with access to new ways of thinking about how to engage *all* of their students with science.

Culturally responsive pedagogy thrives when teachers ensure that students have multiple and diverse opportunities to develop, express, and receive feedback on their understanding of science. Ideally, these opportunities accumulate and enable students to elaborate their science ideas by bringing different experiences and knowledge into dialogue. Culturally responsive pedagogy also thrives when teachers privilege oral and visual presentations (both individual and group) alongside and in addition to individual written presentations. Dramatisation, the production of a physical model or artefact and video are also effective means for communicating, and for receiving feedback on ideas. For many students from Māori and Pasifika backgrounds, teaching other students younger or less skilled than themselves offers a culturally authentic opportunity to show and share what they have learnt.

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