Exploring Mathematics Outside Institutional Walls

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Isn’t it strange that most teacher preparation and school teaching occurs within concrete enclosures? As we and our workshop participants walk together through the university campus and along the river valley, we will discuss the pedagogical significance of connections between mathematics and the natural and constructed things we see. Dress appropriately for walking outdoors. We welcome anyone interested in the possibilities opened up when we take teachers outside classroom walls. Mathematics is not required. At the conclusion of the walk, we will distribute a paper in which we discuss our experiences and the value of taking pre-service mathematics teachers outside. Here is the paper.

Dave (regarding how we came together):
I met Kau’i Keliipio during a coffee break at the 2003 Psychology of Mathematics Education (PME) conference in Honolulu. I described for her some of my experiences taking groups of teachers and preservice teachers for walks to explore mathematics. She responded by telling me about indigenous approaches to living in the world. Because of the connections between my mathematical walks and her sense of indigenous worldviews, we decided to host such a mathematical walk at the upcoming WestCAST conference.

Kau‘i (regarding her interest in culture and mathematics):
Attending the PME conference in Hawai’i last summer was like a voyage of discovery for me. When Sandy Dawson, a colleague of mine who was organizing this conference, first invited me to attend I was surprised. My initial response was to wonder whether I belonged at a conference like that – I wasn’t a professional mathematics educator nor did I feel a sense of competence in the area; however, he insisted that there was relevance to my work in indigenous education, so I decided to attend.

After the opening session of PME I no longer felt like an impostor. Nainoa Thompson, a contemporary navigator/way-farer of the double-hulled canoe Hokule’a told many good stories – stories that I could imagine and relate to – stories that spoke about my ancestors, the Hawai’ians, and the source of their deep navigational understanding. I encountered a number of mathematics educators there, including some Pacific Islanders, who were addressing ethnomathematics and who provided models and examples of the use of ethnomathematics in their schools and classrooms. I was also intrigued by my conversation with Dave Wagner, who described a walking, observational experience in which participants observe human constructions and the natural world as means of enhancing understanding of connections between mathematics and the world. I wondered if an experience like that, brought into the lives of indigenous learners, could
draw out their potentiality, connecting them in a more intimate way to natural surroundings and life.

**Dave (regarding his interest in culture and mathematics):**
Before I began ‘walking mathematically’ with teachers and preservice teachers, I was interested in the connections between mathematics and culture. This interest was prompted by five years of mathematics teaching in Alberta, followed by three years in Swaziland and another year in Alberta. Having recognized the incompatibility of the Swazi’s adopted British mathematics curriculum with their local culture, I returned to a province in the throes of a tension-filled mathematics curriculum change. With my new culture-sensitive eyes, I noted ways in which Alberta’s culture expressed itself in its mathematics curriculum and I noted that among mathematics educators there was little awareness that mathematics had any connection with culture at all.

My new interest in the relationship between culture and mathematics education prompted me to devote some years to its investigation. Early in my graduate studies, I became fascinated with ethnomathematics scholarship. Ethnomathematicians assert that all mathematics is cultural. For example, Alan Bishop, who shows how all mathematics education is a form of enculturation (Bishop, 1988), calls Western mathematics “the secret weapon of cultural imperialism” (Bishop, 1990).

With their interest in culture, ethnomathematicians have investigated cultural artefacts to consider the mathematics expressed in them. Typically, the artefacts studied have been small enough to bring into classrooms – things like baskets. However, ethnomathematical research is not always met with the kinds of attitudes hoped for by the ethnomathematicians. Ubiratan D’Ambrosio (1997), who has been called the father of ethnomathematics has complained:

> There is a general acceptance of and interest in the mathematical ideas of other cultures. Mathematicians and educators seem to enjoy learning about the *tipi* of the prairie cultures […]. A paternalistic curiosity prevails. But when we try to view these facts as complex forms of knowledge […] the reaction met with is disdain and even scorn. (pp. 13-14)

I have noticed how easy it is for me to be blind to my own culture, to think that I am ‘normal’ and everyone else is strange or exotic. My brief immersion in Swazi culture helped me become aware of aspects of my home culture, because they were made strange by my absence. I wondered how to help other people to overcome their cultural blindness. With these reflections I latched on to the work of Gelsa Knijnik (2002), whose brand of ethnomathematics has educators and students investigate the mathematics in their own cultures.

The first time I took a group of teachers on a mathematical walk, I was responding to a sense of compulsion that Heesoon Bai (2001) stirred in me. She writes: “The first step in the cultivation of love is physically taking ourselves to where we want love to take root”
Before this I had been interested in exploring connections between the world outside the classroom and the mathematics done within the classroom walls. I assumed that these explorations could be done within the walls, but Bai made it clear to me that it is not enough to just talk about the outside; we must actually go outside. We need to be outside. And so, I have come to see that walking mathematically affords participants the chance to investigate their own mathematics – their culture’s mathematics. These mathematical walks could be better yet if participants hail from different cultures.

**Kau’i (regarding indigenous learners):**

Over the years, as an indigenous Hawai’ian, I could not help but be aware of the high number of our students who were pushed out of our schools – places where they felt a lack of belonging and connectedness. Mainstream school settings using Western models of education have greatly diminished achievement for indigenous learners. Though I recognize ongoing concerns for aboriginal students’ achievement, I share the concern stated in Prince Rupert School District’s (1997) study on indigenous learners:

> Key questions remain: Why are so many First Nations children alienated from the school system and what can be done to help them become more valued and successful members of their schools? (p. 1)

We continue to seek ways of engaging and teaching our youngsters in culturally sensitive, responsive and responsible ways. We seek methods that have cultural relevance and classroom structures that do not shut down Aboriginal children’s possibilities for participation (see Ward and Bouvier, 2001). I see the walkabout experience that we will be engaged in as a way of bringing to the fore some possibilities for our work with Aboriginal children whose identities and cultural traditions are very much connected to the land (see Orr, 1994). For me, and I hope for others too, this experience is part of my exploration as I consider how I can tie it to the work I do within pre-service education. I want to think about ways we can contribute to the success for increased numbers of indigenous students, but I want more than success for them. I want them to enjoy their education without feeling alienated.

I was sitting in a staffroom recently and heard a teacher say that there is no difference between teaching aboriginal and ‘normal’ kids. I resist this idea, because there are differences. There are many ways of knowing. I also resist the teachers who want quick-fix answers to their aboriginal, ‘problem students’. It seems that these teachers want to find ways of making their aboriginal students ‘normal.’

**Dave (regarding his experiences walking mathematically):**

When I have led walking explorations of mathematics, I have called these interactions “Walking mathematically: exploring the roots and fruits of mathematical activity.” I begin each walk in some kind of indoor meeting room – a classroom or conference room – in which I outline for the participants my vision for the walk. I indicate the form of the walk: we walk together at a pleasant pace and stop to listen to anything anyone wants to say. We try to attune ourselves to the connections between mathematics and the world we see around us while we walk.
We attend to the natural things we come across and ask: how does the world we encounter prompt us to do mathematics in the way that we do it? These connections might be called the ‘roots of mathematics.’ Why, for example, are we humans so interested in right angles? Is there something or some things in nature that prompt us to think about right angles?

We also attend to the human constructions we come across, whether they are physical structures such as roads and buildings or bureaucratic constructs such as the political structure of a hospital. With these we ask: what is it about our mathematics that directs us to structure these things as we do? These connections might be called the ‘fruits of mathematics.’ For example, many of our buildings reflect our fascination with right angles.

The most striking thing that I have learned from walking mathematically is the power of silence, the necessity of silence. The first time I led a group of undergraduate mathematics education students on such a walk, I felt guilty at first. I thought: I am being paid well for this pleasant walk in which I am saying almost nothing. Even my students were silent most of the time. But in their evaluation of the course, a few students cited the walk as the highlight of the course.

We walked for three hours. Every ten or fifteen minutes, someone would point something out and say a few words about it – a tree trunk, the veins in a leaf, a bridge, a brick in a building. Then we’d move on in silence. I know that I spent most of our silent time thinking about what I was seeing and about the observations that I heard so far. Students too seemed to be reflecting. They referred to each other’s observations when making their own observations.

If we believe that learning requires reflection, then we should have times of silence, times when students can reflect on the things said. What value is there in saying many things, if there is no time for reflection? Isn’t it better to say little, and provide ample opportunity for everyone to dwell on each other’s words? Except for typical resistance to doing things differently, there is no reason why we cannot have extensive periods of silence inside classroom walls. Somehow it is easier to remain silent when walking outside.

**Kau’i (regarding silence):**

It is interesting that Dave speaks of the necessity of silence. In a recent conversation I had with a primary school teacher, the teacher described aboriginal learners as non-verbal, silent students. It seems that many non-aboriginal teachers are unable to read the quiet culture-specific gestures and watchfulness of their aboriginal students. Usually the quiet gestures of indigenous learners are passed over and not read as learning behaviours.

**Dave (regarding more experiences walking mathematically):**

While walking mathematically, I have also been struck by the differences between my perception and my expectations, and I sensed that the people who have walked with me
have had the same experience. I mentioned above our human fascination with right angles. Before my first time walking mathematically, I thought that this fascination was connected to the many right angles we see daily where tree trunks meet the ground. However, the most awe-filled observations in my walks have related to the imperfection of our natural world. There are no straight tree trunks. They twist and turn. There are no right angles between trunks and the ground. The ground is rarely level and trees do not grow straight. They lean from the wind and toward the light. But behind all this imperfection, we see the idea of a right angle and the idea of straightness. ‘Imperfection’ is the wrong word, but there is no right word.

Though my walks with students and teachers have been wonder-full, they had their disappointments. When I was walking with one undergraduate group through the university campus, we stopped on a small hill to talk about a bush. Passers-by laughed at us. Their laughter bothered me more than I expected it would. If education is about the world, then why should it seem so strange for students and educators to be outside walking around? If we laugh at anyone’s education, we should laugh at (or pity) the people closed inside classroom walls. And the walls are symbolic of the many other barriers between what happens in classrooms and what happens outside the walls.

When I taught high school, I used to teach with my door open. I thought it strange that some of my colleagues began each lesson by closing their doors. Now I wish that I would have taken my open door more seriously and walked through it with my students to experience the world.

**Kau’i (regarding what she hopes to learn while walking mathematically today):**
When I think about this particular walk, it helps me connect better with the ways of communicating and interacting that are familiar to me. I don’t often find these modes of communication within the university culture. A lot of my contributions to the professional development program at Simon Fraser University have involved bringing in aboriginal people who do things differently from normal academics. They talk about the world differently.

I am thinking now of a person who brought in some of his weaving, and talked about the way he did this weaving, connecting it to the way he lived his life (note interesting connections here to ethnomathematics – some people would say there is mathematics in his weaving). Many university people seemed to wonder what this person had to say in the university setting. It is only long after this weaver left the university that some people began to realize the value of his visit.

**Dave and Kau’i (regarding our writing together):**
It was challenging to write this together. The sense of urgency we felt goes against the grain of the kinds of experiences we want to support. We did not want write a lot of words, because there is power in silence (but Dave has a little harder time keeping his word count down). We want to give our readers a few words to prompt their own reflection.
References


