MathsReach

The MathsReach website now includes more than 30 video interviews with a range of mathematicians, and more than 30 stories from *IMAges*. Topics range from asteroids, bugs and codes to primes, quandles and rats.

Jeanette Saunders, HOD Mathematics at St Cuthbert's College in Auckland, says there is no other New Zealand website that shows the applications of maths.

"Without MathsReach, neither students nor teachers would know the breadth and relevance of maths to modern careers. I see MathsReach actively countering the perception that 'maths is not for me'. It's a unique connection between maths in secondary schools and the wider world."

See www.mathsreach.org.nz/

Crocheting the hyperbolic plane

Maths students around the country could have their physical models of hyperbolic planes on display under their names in the Auckland Museum - all they have to do is learn simple crochet. Jenny Rankine explains.

The museum's Seagardens Project will be displayed in the Oceans Gallery until May 16 showing crocheted models of hyperbolic sea life.

The Seagardens Project is affiliated with the Hyperbolic Crochet Coral Reef project, initiated by two Queensland sisters in homage to the threatened Great Barrier Reef. It was based on the first easily usable physical models of hyperbolic space, developed by mathematician Daina Taimina in 1997, using ideas from William Thurston.

Taimina, a skilled knitter and crocheter, realised that crochet was the best medium to demonstrate the non-Euclidian properties of hyperbolic geometry. In this geometry, for any given line L and point p not on L, there are at least two distinct lines through p that do not intersect L. The angles of a triangle in hyperbolic space also add up to less than 180°.

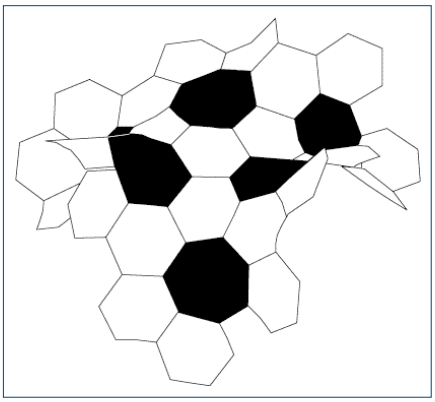
In March Taimina's book, *Crocheting Adventures with Hyperbolic Planes*, won the 32nd annual Diagram Prize for the oddest book title award of 2009, from a record 90 entries. The book and the projects reflect a unique combination of maths, community art and marine biology.

The Seagardens and HCCR projects require contributors to use a simple algorithm to construct their planes. Former Seagardens Co-ordinator Glenys Stace said this is easy for complete beginners. She suggested crocheters choose any number of stitches (around five works well), crochet that number and add another stitch in the last hole. Repeating that process quickly develops ruffling that can be wrapped into a huge variety of shapes, each called an embedding in 3-space.

Unlike a flat sheet of Euclidian paper, which can be wrapped only into a simple cylinder or a cone, hyperbolic planes can be wrapped into multiple flutes without deforming their geometry. In the Seagardens installation, these simulate anemonies, branched corals and loopy kelp.

Christine and Margaret Wertheim co-direct the Institute For Figuring, an educational organisation based in Los Angeles. Their HCCR project has developed six different crochet coral reef exhibitions.

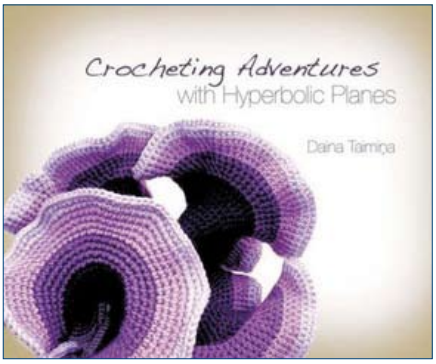
Post your creation to Vincent Lipanovich, Auckland Museum, Private Bag 92018, Auckland, phone him on 09 309 0443 x 924, or email vlipanovich@aucklandmuseum.com



Blue: Three straight lines - geodesics - in a hyperbolic plane pass through a point external to the line at the bottom without intersecting it.

Red: Illustrates the narrow angles of a triangle on a hyperbolic plane.

Black and white: A hyperbolic soccer ball model, created by Taimina's son Keith Henderson, replaces the five-sided pentagons with seven-sided heptagons and includes seven six-sided hexagons for every five in the original shape. Instead of closing into a sphere, the surface opens out and curves away from itself.



See also

http://crochetcoralreef.org/

www.math.cornell.edu/~dtaimina/

http://theiff.org/oexhibits/oe1.html

Video: www.ted.com/index.php/talks/margaret_wertheim_crochets_the_coral_reef.html

Maori & Pasifika maths students


Photo: Azra Moeed

How to get the best out of Maori and Pasifika students? That is the central and most pressing question for secondary mathematics teachers in New Zealand. Glenda Lewis reports.

Robin Averill chose this complex phenomenon for her PhD study, part funded by an NZIMA scholarship. This was where her interests impelled her and she felt she could make the most useful contribution. Averill teaches education students how to teach mathematics at Victoria University's College of Education, based in Karori, Wellington.

Russell Bishop's 2003 investigation into the experience of Year 9 and 10 Maori students in phase 1 of Te Kotahitanga project concluded that teacher-student relationships have the biggest influence on Maori achievement.

Averill wanted to know exactly what about those relationships was important, and whether it was the same for Pasifika and New Zealand European students?

Her research was largely qualitative. She observed six teachers in three decile 3 to 5 schools over two years. She chose Year 10 classes to avoid muddying the waters with NCEA and the settling-in problems of Year 9 classes.

She also focused on students who were likely to go further in mathematics study. She began her observations at the very beginning of the year so she could see how teachers established themselves with students and how relationships developed during the year.

She recorded teacher and student interactions and their individual perspectives under three areas: care for students as individuals, as culturally located beings, and care for students' mathematical learning

Her conclusions about the most important aspects of relationships applied across all three areas and can be simply summarised:

- Respect for the student
- One to one interaction, about mathematics or anything else
- Humour
- Teachers being themselves, and allowing students to be themselves.

The quality of the relationship, however, can be undermined by low teacher expectations. Students' priority is still to learn mathematics, not just have a good time in the classroom.

Averill found that students responded well to very structured classes, especially where there was variety, where they could contribute ideas, and where the activities gave the teacher opportunity to give them individual attention.

Not all teachers are natural humorists, but showing a sense of humour is important to fun-loving teenagers. Even teachers who smile a lot are appreciated. This is at odds with the oft given informal advice to new teachers not to smile before Easter, or to let down their guard. Many teachers keep their personal lives very private. Students like to know about the whole person, not just the teacher, and vice versa. Importantly, teachers do not have to be Maori or Pasifika for students to feel a good rapport with them.

Averill says that teachers need to be aware of students' overall wellbeing, as Mason Durie outlined in 1994 in the Maori health model Te Whare Tapa Wha - the four-sided house. So often what gets in the way of learning are simple things like being cold, uncomfortable, hungry and tired. That applies to all students, of course.

Averill received high praise from her assessors for her study. Her teacher care whare model draws from and integrates modified versions of previous frameworks, including Te Whare Tapa Wha, the effective teaching profile from Te Kotahitanga, and one from Averill's team at Victoria University of Wellington.

Averill says that what surprised her about the PhD process was the huge number of people involved – the teachers, students, cultural advisers, supervisors, and colleagues. It takes a village to raise a child, they say, and in this case an entire academic community to produce a doctoral thesis of substance.

See also:

R. Bishop, M. Berryman, S. Tiakiwai and C. Richardson, 2003. *Te Kōtahitanga Phase 1: The Experiences of Year 9 & 10 Maori Students in Mainstream Classrooms*. Ministry of Education.

Mason Durie, 1994. *Whaiora: Māori Health Development*. Oxford University Press, Auckland.

In a universe of 0s and 1s, we catch a glimpse of immortality; we behold the gilded gates of eternity flung wide open by the bewitching magic of a lonely pair of incandescent symbols. In short, analogue sucks, digital rocks.

Bernard Chazelle, 2006