# Challenge in New Zealand: A Brief Survey

By

Derek Holton

Department of Mathematics and Statistics, University of Otago

Abstract

In this note I will restrict my coverage to able students but I will look at what challenges are available both inside and outside of school. For more details you might look at the web site www.maths.otago.ac.nz and click first on 'resources' in the School Section and then on 'help for gifted children'.

## Background

At the outset I think that it is important to note that New Zealand is a country with about 4 million inhabitants spread over an area comparable to that of Great Britain but with relatively few major centres surrounded by farmland and mountains. Even more than Australia its heritage is British but there was a strong Maori presence, Polynesian in origin, well before any Europeans reached its islands.

## The School Scene

In 1992 a new mathematics curriculum was developed in New Zealand (Ministry of Education, 1992). This was part of an attempt to provide curricula for all subjects that covered all years of schooling. So, for the first time, the country had a syllabus that went from the first year of schooling up to the last.

One important aspect of this curriculum was that it acknowledged in two ways that different children learn at a different rates. The first way was to divide the curriculum into 'Levels' that were not confined to school years. For instance, students mainly in Years 4 and 5 would be studying at Level 2, but it was understood that some children would be working at Level 2 before Year 4 and some would not be at this level until later than Year 5. In order to foster the students who were working at a given level earlier than their peers, the Development Band was initiated. So in each level of each strand (Number, Geometry, etc.) of the curriculum some sample activities are suggested for the teacher to use. Below we give some examples of these.

### Number, Level 2

- Students invent, and make up rules for, games based on a set of numeral cards or a calculator
- Students document and explain how the use of the Maori language supports the idea of place value
- Students explore numbers in other bases, say base 2

### Measurement, Level 6 (Years 11 and 12)

- By writing their own computer program, or in some other way, students construct a series of fractals, such as the Koch (simple snowflake) curve, and investigate factors which determine the perimeter and area of a fractal
- Students use a computer or calculator to finds the area of an interval under a curve by subdividing the area into smaller and smaller sub-intervals, approximating them to trapezia, and adding their areas
- Students plan nets for, and construct, a number of regular-shaped solids with specified parameters, for example, a regular tetrahedron with a volume of 1 litre

So the basis for providing additional material for bright students had been established. The New Zealand Association of Mathematics Teachers (NZAMT) was quick to build on this by developing a Development Band Certificate programme, some details of which can be found on their web site by following 'Development Band' (see NZAMT, 2006).

Initially then, it looks as if bright students in New Zealand are well challenged. In fact, my feeling is that pre-secondary school there is not a great deal available in the average school. This is largely because primary school teachers are not mathematics experts and so don't know how to challenge their more able students. But even in secondary school things are not as good as they might be. In the last three years of schooling we have national high-stakes assessment. The emphasis on challenge there is to get the students through the exams. Rarely is there a chance to challenge individual students. The more able are either accelerated through the system or take a broader range of subjects.

The main area of schooling that does provide challenge is the junior secondary school. Here first there are teachers who are experts in mathematics and second there is sufficient slack in the system for the more able students to be able to be challenged. At this level teachers are much more likely to deviate from the main programme and introduce some problem solving or investigation or Development Band activity.

Outside School

Much of what is available to challenge the able students outside school in an institutionalised form, developed from the mid 1980s and the desire to do something for the mathematically gifted by entering a New Zealand team in the International Mathematical Olympiad. At the same time there was a hope that that work would influence mathematics teaching as a whole and lead to an understanding of what research mathematicians really did and hence what mathematics really was. The idea was that mathematics was not just about solving problems like the following.

Find a and b if the following two subtractions are equal.

| | |
|---|---|
| 4ab | 400 |
| -400 | -ab4 |

Rather that the solution of the above problem was a starting point to see what happens first, if all the 4s were changed to 5s and so on, second, to see what happens if the

number of zeros was steadily increased, and third, to see if any of the guesses about that behaviour could be proved.

With this philosophy behind them, the New Zealand Mathematical Olympiad committee was formed and managed to get a team together for the 1988 IMO in Australia. It is likely that the group also had some influence on the new curriculum of 1992.

Up to that point the notion of gifted mathematicians and the idea of doing something for them was considered to be elitist. So there was a certain amount of initial resistance to the Olympiad movement even though there was already one major local competition in existence organised by Canterbury University for senior students. (Students at a range of levels had also been taking part in the Australian Mathematics Competition for some time.)

So the major outside school challenges at that time were being provided by competitions. This is still true with the senior competition now being run by NZAMT under the name the Eton Press Senior Mathematics Competition (see the NZAMT site). However further competitions include a junior secondary competition and a primary competition being provided annually by Otago University (see www.maths.otago.ac.nz via the Schools Section) and a local Auckland competition being organised by Auckland University. But other avenues apart from competitions are available.

The New Zealand Mathematical Olympiad Committee runs a selection process towards the end of the year. From this around 20 students are chosen to take part in a mathematics camp in January where there is intensive training and where a smaller group is selected to participate in further training. A few months later the final team is selected and they have more problems to work on until they go off to the IMO in July.

If you are a student who is keen on mathematics then you are better off to live in Auckland, Christchurch or Dunedin because this is where most is happening for you. For instance, Auckland University runs a Certificate programme for senior students. This involves the students in reading set material and answering questions based on this material about four times during the year. The IMO training camp is held in Christchurch but in parallel with this camp there is a ‘day’ camp for local secondary students based around hour sessions on suitable problems and material given by local academics and training camp presenters. This camp has grown out of regular monthly evening sessions in that city. Correspondence courses are available from Canterbury and Otago Universities (these universities are in Christchurch and Dunedin, respectively). And these three universities also have people who are willing to go into schools to give talks or work with the students on problem solving activities. Otago University also gives a 9-week problem solving course for 16 year olds.

Conclusion

The above largely covers the providers of mathematically challenging activities in New Zealand. The main omission is probably the hands-on sections of museums in all of the main centres. However, the activities they provide are more science than mathematics based.

In recent years it is true that increased attention has been paid to mathematically capable students in New Zealand. It should be noted though, that the work out of school is almost entirely left to volunteers. There are few systems in place to guarantee the continuation of their work. It is of concern too that the work in schools is being done by teachers who are having increasing demands being made on their time. So, despite the existence of the Development Band and the work of the Olympiad Committee, the future of challenges for mathematically able students is not assured.

References

Ministry of Education, 1992. Mathematics in the New Zealand Curriculum. Wellington: Ministry of Education. (http://www.minedu.govt.nz/web/downloadable/dl3526_v1/math-nzc.pdf)

NZAMT, 2006. http://www.nzamt.org.nz/