MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

NUMERACY IN NEW ZEALAND:
THE NEXT STEPS
THE 2008 RESEARCH FINDINGS

Since 2000, raising student achievement in mathematics by increasing the capability, knowledge, and confidence of teachers has been at the heart of the Numeracy Development Projects (NDP).

Nearly all primary and intermediate schools have participated in the English-medium NDP or the Māori-medium Te Poutama Tau. A growing number of secondary schools are involved in the Secondary Numeracy Project (SNP) or the wharekura Te Poutama Tau, both of which focus on years 9 and 10.

Phase two of the NDP focuses on consolidation and sustainability, although provision is made to "pick up" teachers new to the NDP approach.

Research and evaluation has always been a key component of the NDP, with findings informing ongoing policy and professional development. The 2008 research provides evidence that the NDP continue to make a positive difference to student achievement. Analysis of the findings shows that the NDP have provided a solid foundation for the implementation of National Standards, which will become part of quality teaching and learning in year 1–8 classrooms.

A key government priority is for all students to achieve numeracy levels that enable their success. Effective numeracy teaching can lift student achievement and help them to maintain steady progress: underachievers can make up to two years' progress in one year and they can be brought up to national curriculum level expectations. This progress can be sustained with effective teaching.

2008
NUMERACY DEVELOPMENT PROJECTS EVALUATION AND RESEARCH

NDP, Te Poutama Tau, SNP, and wharekura Te Poutama Tau researchers focused on:

- student achievement
- professional practice
- evaluation of initiatives.

The 2008 compendia and pamphlet are available online at www.nzmaths.co.nz/numeracy-references

Areas for further teacher education to help achieve this are signalled in the research.

Teachers who focus on educationally significant learning and set high but attainable standards are able to raise student achievement. National Standards will define expectations of what students should be able to do at each point in their schooling and will ensure that students not achieving in mathematics are identified early.

Evaluations	Evaluators and Papers
Participants rated two programmes for teachers new to the NDP as being of value and helpful to teachers' learning. Group sessions and in-class support were the most valued features of both programmes.	**Gregor Lomas** *The impact of two professional development programmes for numeracy "pick ups": Teachers' perceptions of valued aspects*
Students of teachers in the national pick-up programme (for those new to the NDP) made good progress in numeracy as measured against the Number Framework. Student achievement improved at a similar rate to the improvement seen in students in schools participating in the full-school NDP professional development.	**Andrew Tagg and Gill Thomas** *Numeracy Development Projects' patterns of performance and progress: National pick-up programme 2008*
Support from an individual rather than from a group was deemed most helpful. Most teachers involved in tertiary study in mathematics identified time and variable levels of support from their schools as issues.	**Margaret Thomson** *Do groupies do better? Perceptions of practising teachers undertaking tertiary study in mathematics*

PROFESSIONAL DEVELOPMENT FOCUS FOR 2009

Mathematics professional development aims to improve student achievement in mathematics by improving the professional capability of teachers. Quality teachers have a thorough understanding of the mathematics they teach, of how students are likely to learn it, of misunderstandings that students are likely to encounter, and of the misconceptions that students may bring to class.

The focus in 2009 is on:

- developing the professional capability of principals, lead teachers, and teachers, including teachers of year 1–4 students, through classroom-based ongoing professional learning;
- collecting, analysing, and using appropriate assessment information to inform classroom practice;
- supporting students who are not achieving as expected, for example, "at risk" and "cause for concern" students;
- supporting effective teaching and learning programmes in multiplicative thinking, division, fractions, decimals, and proportional thinking;
- supporting the use of appropriate recording and information technology and developing local and regional networks of professional practice;
- supporting the mathematics and statistics learning area and the integration of Number and Algebra, Geometry and Measurement, and Statistics into schools' mathematics programmes;
- supporting schools as they build numeracy education partnerships with their parents, communities, and whānau;
- promoting and encouraging career pathways for pāngarau and mathematics teachers through graduate and/or postgraduate studies in numeracy and mathematics education.

Professional Practice	Evaluators and Papers
Students of teachers who scored highly in the content measures of the teacher-knowledge assessment made significantly greater gains than students of teachers who scored poorly in the content measures.	**Jenny Ward and Gill Thomas** *Linking teacher knowledge and student outcomes*
Children start school with a wealth of mathematical knowledge and experiences; the new entrant teacher's recognition of this rich resource may facilitate the smooth transition of a child into school.	**Ngaire Davies** *Mathematics from early childhood to school: Investigation into transition*
Most students successfully negotiated the transition from year 6 to year 7. In numeracy, there was evidence of "fresh-start" practices that included reassessments, a lack of curriculum continuity, and mistrust between sectors.	**Brenda Bicknell and Roberta Hunter** *Explorations of year 6 to year 7 transition in numeracy*
The schools in the study recognised the need for some organisational structures to be modified in order to continue focusing on improving students' achievement. Students' achievement was a key factor in embedding numeracy in the school.	**Joanna Higgins and Linda Bonne** *Embedding the Numeracy Development Projects in two schools*
Strong within-school networks and continued access to external facilitators were identified as effective ways of supporting teachers. Release time for interaction was regarded as important for improving numeracy teaching.	**Joanna Higgins and Linda Bonne** *Networks of support and influence in the Numeracy Development Projects: A case study of two schools*
A school's use of formative assessment data, such as numeracy diagnostic interviews, contributes to sustaining and strengthening its focus on improving students' achievement.	**Joanna Higgins and Linda Bonne** *The role of the diagnostic interview in the Numeracy Development Projects*

Student Achievement	Evaluators and Papers
Students who have been in NDP classes since 2002 continue to achieve well in number and in other areas of mathematics. Numeracy strategy stages can reliably be used to predict overall mathematics ability.	**Gill Thomas and Andrew Tagg** *The Numeracy Development Projects' Longitudinal Study: How did the students perform in year 7?*
Students of teachers in their first year of NDP professional development show marked improvement in achievement. A school's decile seems to have an impact on students' performance and progress.	**Jenny Young-Loveridge** *Patterns of performance and progress of NDP students in 2008*
Students' achievement continues to improve, particularly in the knowledge domains, when their teacher is involved in Te Poutama Tau. Language proficiency seems to have an impact on progress in strategy domains.	**Tony Trinick and Brendan Stevenson** *Longitudinal patterns of performance: Te Poutama Tau*
The year 4 and year 7 Te Poutama Tau students in this study performed above the Māori-medium national asTTle norms on number items.	**Tony Trinick** *Te Poutama Tau student performance in asTTle*
Array-based material seems to be useful in developing students' understanding of multi-digit multiplication. Students taught to use standard written algorithms (or the grid method without understanding it) may struggle to develop relational understanding.	**Jenny Young-Loveridge and Judith Mills** *Supporting multiplicative thinking: Multi-digit multiplication using array-based materials*
The Māori-medium students in this study used a range of mental strategies to solve problems, and most of them were able to communicate their ideas in te reo Māori.	**Ngārewa Hāwera and Merilyn Taylor** *Some strategies used in mathematics by Māori-medium students*

RESEARCH FOCUS FOR 2009

In both English- and Māori-medium settings (in primary and intermediate schools and kura and in secondary schools and wharekura), researchers are continuing to focus on the achievement of all students and on the professional capability of teachers in mathematics.

The research includes:

- identifying trends and patterns in the performance and achievement of students involved in the Te Poutama Tau project;
- evaluating the third year of the wharekura Te Poutama Tau project, with a focus on student achievement and teacher knowledge and practice;
    - charting the patterns of progress of students in their schools' second and third years of involvement in the NDP;
- continuing the Longitudinal Study by investigating the mathematics ability of year 8 students and the effect of parental attitudes and mathematics qualifications on the performance and progress of the students;
- investigating the patterns of leadership enactments associated with achievement for all students, but specifically for Māori students in both Māori- and English-medium settings;
- identifying features that beginning teachers and "pick ups" see as being of particular value in constructing their understanding of, and confidence in, teaching and learning mathematics and gaining pedagogical content knowledge;
- investigating teachers' understanding of part–whole thinking and its impact on their teaching;
- identifying the key features that contribute to students moving from stage 5 (early additive part–whole thinking) to stage 6 (advanced additive part–whole thinking);
- investigating the transition of students from intermediate to secondary schools.

	Evaluators and Papers
Year 9 students in 2008 SNP schools made similar progress to those in earlier years. The end-of-year performance of 2008 year 9 students in schools in their second year of the SNP was similar to year 9 results for 2007, but the impact of the SNP on year 10 students in those schools was small.	**Andrew Tagg and Gill Thomas** *Performance of SNP students on the Number Framework*
The revised and modified Written Strategy Stage Assessment Tool (WSSAT) has reasonably high levels of internal consistency for numeracy stages 5–8 and can be used to assign students a global numeracy strategy stage.	**Gregor Lomas and Peter Hughes** *Written and oral assessments of secondary students' number strategies: Ongoing development of a written assessment tool*
It can be useful to group students for algebraic instruction according to their most sophisticated algebraic strategy, which is related to their numeracy strategy stage. Students found equations in contexts easier to solve than the corresponding symbolic equations.	**Chris Linsell** *Students' knowledge and strategies for solving equations*
SNP practices used by teachers in their junior classes can be successfully implemented in senior classes. There was increased emphasis in the study schools on student thinking and mathematical understanding and the use of real-world contexts.	**Roger Harvey and Robin Averill** *Senior secondary numeracy practices in successful schools*
The establishment of a professional development programme dedicated to wharekura pāngarau has proved to be successful. Long-term facilitator involvement and the recognition of kaupapa Māori are important. Online systems (for example, wiki and WiZiQ) and facilitator liaison with tumuaki of kura were used, but face to face was still the preferred mode for communications.	**Pania Te Maro, Robin Averill, Joanna Higgins, and Brian Tweed** *Fostering the growth of teacher networks within professional development: Kaiako wharekura working in pāngarau*
On tests done without calculators, there was little difference in progress between students using CAS calculators in class and those in the control groups. Students reported a better understanding of algebra as a result of the CAS approach to teaching and learning.	**Alex Neill and Teresa Maguire** *Student learning and understanding in the CAS Pilot Project*

MINISTRY OF EDUCATION RESOURCES

New **Figure It Out** student books, with Answers and Teachers' Notes: ***Statistics: Revised Edition***, levels 2–3, 3, and 3–4 (distributed November 2008)
Statistics in the Media, levels 3⁺–4 and 4–4⁺ (distributed July 2009)

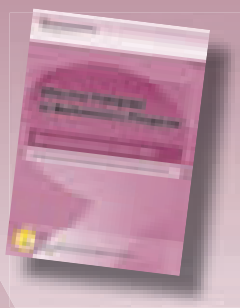
Answers and Teachers' Notes for all Figure It Out books are available online:
www.nzmaths.co.nz/figure-it-out

Figure It Out in the process of development and publication: Four books with a science focus (distribution April 2010) and four books with a technology focus (distribution late 2010)

Numeracy Development Projects resources
www.nzmaths.co.nz/teaching-numeracy
www.nzmaths.co.nz/te-poutama-tau

NDP support books
The latest editions of these books are available online:
www.nzmaths.co.nz/node/1591

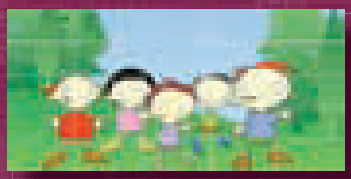
BES
Effective Pedagogy in Mathematics/Pāngarau: Best Evidence Synthesis Iteration (BES) by G. Anthony and M. Walshaw draws together research evidence about what pedagogical approaches work to improve student outcomes in pāngarau and mathematics.
www.educationcounts.govt.nz/publications/series/2515/5951



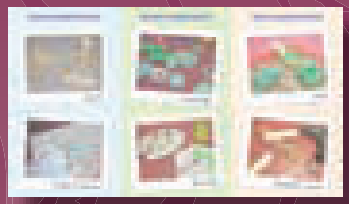
Earlier NDP research and evaluation reports and compendia
www.nzmaths.co.nz/numeracy-references

Mathematics/Pāngarau learning objects
www.nzmaths.co.nz/digital-learning-objects
www.nzmaths.co.nz/node/1472

The digital learning objects are interactive online resources that focus on key mathematical concepts for students in years 1–10 and are designed to engage and motivate student learning.

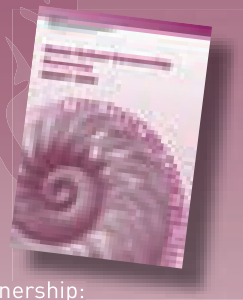


Early childhood education material
nzmaths now provides material on early learning progressions for areas of mathematics such as number, shape, and measurement, including examples of interaction starters.
www.nzmaths.co.nz/node/4973



Family section
This section on the nzmaths website provides information and activities for parents and whānau to help them support their children's learning.
www.nzmaths.co.nz/node/453

Home–School Partnership: Numeracy
The *Home–School Partnership: Numeracy* handbook (draft) has been written to help schools and communities as they work together to support children's achievement in numeracy. The suggestions in it are intended as a guide for principals, teachers, and parents when planning Home–School Partnership: Numeracy sessions. It is available on nzmaths, with links to all the games and activities.
www.nzmaths.co.nz/node/1373



Expectations of student achievement for years 1–8
The expectations show the numeracy stages and curriculum levels expected by the end of each school year and provide an indication of when students are "at risk", "cause for concern", "at or above expectations", or "high achievers", to assist school leaders and teachers.
www.nzmaths.co.nz/node/1481

Further information on the NDP, including names and email addresses of regional co-ordinators, is available online at: www.nzmaths.co.nz/numeracy-project-information

Published 2009 for the Ministry of Education by Learning Media Limited, Box 3293, Wellington 6140, New Zealand. www.learningmedia.co.nz

Copyright © Crown 2009. All rights reserved. Enquiries should be made to the publisher.

Photographs by Adrian Heke, copyright © Crown 2007

Thanks to the Wellington facilitators and to the students and teachers from Te Kura Kaupapa Māori o Te Ara Whanui, Kelson Primary School, Avalon Intermediate School, and Tawa College who took part in the 2007 numeracy photoshoot.

Additional copies of this pamphlet are available free on request and can be ordered through Ministry of Education Customer Services, freephone 0800 660 662, freefax 0800 660 663, by email: orders@thechair.minedu.govt.nz or online at www.thechair.minedu.govt.nz

Please quote item number 11441.

This pamphlet can be accessed at www.nzmaths.co.nz/numeracy-references

newzealand.govt.nz