MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

NUMERACY IN NEW ZEALAND: MOVING ON

THE 2007 RESEARCH FINDINGS

Since their inception in 2000, the Numeracy Development Projects (NDP) have improved student achievement in mathematics by increasing the capability, knowledge, and confidence of teachers. Experienced numeracy facilitators, working alongside principals and teachers, have witnessed students' knowledge, understanding, and enjoyment of mathematics increase as a result of their teachers' involvement in these professional development projects.

By the end of 2008, approximately 95% of New Zealand primary and intermediate schools, 40% of our secondary schools, and 85% of our Māori-medium schools will have been involved in their initial two years of numeracy professional development. Findings from the 25 research and evaluation papers summarised in this pamphlet demonstrate consistent improvement in both student achievement and teacher capability. They also indicate the areas that need further professional development and improvement.

An initial two-year professional development programme will continue to be offered to schools that have not yet taken up the opportunity to participate in the NDP. Schools that have already participated in the initial phase will be offered additional professional development through a second phase of the projects. This professional development will be contextually responsive to the needs that schools and teachers identify for themselves. These needs are likely to include further development in: addressing equity for all learners; contexts for learning; and the new mathematics and statistics learning area.

There are exciting times ahead, and we look forward to further improvements in achievement for all students as we continue to equip them with the knowledge, skills, and values they need to be successful citizens in the 21st century.

2007 NDP RESEARCH AND EVALUATION

Researchers focused on English-medium and Māori-medium (Te Poutama Tau):

- student achievement
- professional practice
- evaluations of initiatives.

2007 SNP RESEARCH AND EVALUATION

Researchers focused on English-medium and Māori-medium (wharekura Te Poutama Tau):

- student performance and progress on the Number Framework
- professional practice.

The printed compendia (selected NDP papers and the full SNP) are available from Ministry of Education Customer Services (see details on back). Please quote item number 33262 [NDP] or 33268 [SNP].

The full compendia are available online from www.nzmaths.co.nz/numeracy/References/compendium07.aspx

FINDINGS FROM THE NUMERACY DEVELOPMENT PROJECTS 2007
(PRIMARY AND INTERMEDIATE)

Student Achievement	Evaluators and Papers
Students who had been in numeracy classes for six years in the same school had the highest achievement. Once students are achieving at expected levels, they are likely to achieve at expected levels in subsequent years.	**Gill Thomas and Andrew Tagg** *What do the 2002 school entrants know now?*
Student achievement improved as a result of their teachers' involvement in the NDP. Place value and basic facts knowledge is vital for strategy development.	**Jenny Young-Loveridge** *Analysis of 2007 data from the Numeracy Development Projects: What does the picture show?*
Student achievement improved during 2007 for those in their first year of Te Poutama Tau (the Māori-medium numeracy project). There have been positive longitudinal trends (2004–2007) in most areas of Te Mahere Tau (the Number Framework).	**Tony Trinick and Brendan Stevenson** *Te Ara Poutama: An evaluation of Te Poutama Tau 2007*
The year 7 students in this study performed significantly above the asTTle national norms for pāngarau in Māori-medium schools.	*** Tony Trinick and Peter Keegan** *Te Ara Poutama: The impact of the Te Poutama Tau project on mathematics achievement*
Most of the Māori-medium students interviewed believe that mathematics is important for various reasons, although only about one-third had set goals for learning mathematics.	*** Ngārewa Hāwera and Merilyn Taylor** *Māori and mathematics: "Nā te mea he pai mō tō roro!" (Because it's good for your brain!)*
Māori students in English-medium schools benefit from their teachers' involvement in the NDP. Effective teaching practices identified were: a safe professional school environment; focusing on Māori students' achievement; and culturally responsive relationship-building teaching.	**Pania Te Maro, Joanna Higgins, and Robin Averill** *Creating strong achievement gains for Māori students in English-medium mathematics classrooms*
There is a positive move in some schools towards teaching basic facts in mathematics and basic sight words in spelling for understanding and use, although assessing what had been practised, with little teaching, seemed to be common.	*** Brenda Sherley and Sandi Tait-McCutcheon** *Practice + assess ≠ knowledge: Basic facts and spelling lists*

*** Available in full compendium online**

RESEARCH FOCUS FOR 2008

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 numeracy and mathematics.

This focus includes the development of:

- written assessment tools for students in number and algebra;
- a teacher assessment to assist in targeting professional development.

Researchers are also investigating:

- links between teachers' pedagogical and content knowledge and student achievement;
- the support of teachers new to numeracy schools;
- the support of pāngarau teachers in wharekura;
- patterns of performance and progress in students of different gender, ethnicity, and socio-economic status;
- the performance and progress of students in Māori-medium settings;
- approaches for promoting students' multiplicative and proportional thinking;
- ways of improving the learning and achievement for students identified as "at risk" and "cause for concern";
- the practices that facilitate positive transitions between early childhood education settings and school and between primary and intermediate schools.

Professional Practice	Evaluators and Papers
Teachers' content knowledge of fractions has a strong impact on their ability to teach that content and on the achievement of their students.	**Jenny Ward and Gill Thomas** *Does teacher knowledge make a difference?*
Video analysis linked to key elements in an effective mathematics lesson can provide "hard data" for reflecting on practice and planning for professional development.	*** Sandi Tait-McCutcheon and Brenda Sherley** *Stepping out of the stream: Reflecting on action*
A course in mathematics knowledge for teaching improved the teachers' mathematics content knowledge and their ability to understand and remediate students' misunderstandings of fractions.	**Fiona Ell, Gregor Lomas, Linda Cheeseman, and Peter Nicholas** *Improving knowledge of mathematics for teaching: Investigating the effects of an in-service intervention*
Multiplicative thinking involves some very challenging concepts, for the teachers as well as for the students. Improving the teaching and learning of multiplicative thinking requires considerable time and energy on the part of teachers.	**Jenny Young-Loveridge** *Multiplicative thinking: The challenge for teachers of moving from a procedural to a conceptual focus*
Professional development focusing on statistics led to an increase in teacher confidence, clarity, and capability in teaching statistics and improved student outcomes.	**Sandi Tait-McCutcheon and Brenda Sherley** *Statistics professional learning and development*
Teachers were positive and confident about using ICT, although they used it less in mathematics than in other learning areas. Teachers used ICT in mathematics for a variety of purposes, with students grouped in various ways to suit the activities.	*** Ruth Pritchard and Chanda Pinsent** *Interface @ the chalkface: Investigating the interaction and influence of numeracy and ICT professional development initiatives on classroom practices*
Effective inter- and intra-school relationships, whole-school community involvement, shared practices, and a collective focus contribute to sustaining communities of practice.	*** Brenda Sherley and Sandi Tait-McCutcheon** *Communities of practice: Prepared for the now, planned for the future*
Children in early childhood education have diverse and rich mathematical experiences. Assessments tended to focus on disposition to learning. There seemed to be no formalised procedures for sharing children's progress with schools. (Preliminary findings)	*** Ngaire Davies, Karen Walker, and Margaret Walshaw** *Mathematics and numeracy in schools and early childhood education services: Investigation into transitions*

*** Available in full compendium online**

Evaluations	Evaluators and Papers
Home–School Partnership: Numeracy (HSPN) helps schools build relationships with their communities. HSPN seemed to act as a catalyst that supported schools in improving the way they connect with parents and the community.	**Jonathan Fisher and Alex Neill** *Evaluation of Home–School Partnership: Numeracy*
Teachers found the coaches to be a valuable way of extending and consolidating their mathematics teaching expertise. In-school availability and one-to-one coaching were key aspects of the knowledge and pedagogy support given to year 6–8 teachers in the pilot project.	*** Roger Harvey** *Evaluation of the Mathematics Coaches Pilot Project*
The use of a video link to provide professional development to numeracy facilitators throughout New Zealand had mixed results, including concerns about timing, location, and the technology, although discussion with colleagues was valued highly.	*** Fiona Ell and Gregor Lomas** *Using a video link to engage numeracy facilitators in professional development in mathematics*
Applicants, who were mostly lead teachers or a group from the same school, came from a wide geographical spread, all class levels, and a wide range of teaching and NDP experience. (Interim findings)	*** Margaret Thomson** *Tertiary Fees Funding Support Initiative: Interim report on data relating to successful applicants*

* Available in full compendium online

PROFESSIONAL DEVELOPMENT FOCUS FOR 2008

Numeracy and mathematics professional development aims to improve student achievement in mathematics through 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 2008 is on:

- developing the capability of teachers and lead teachers, particularly of year 5–8 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, particularly year 5–8 students;
- supporting effective teaching and learning programmes in multiplicative thinking, division, fractions, decimals, and proportional thinking and the use of appropriate recording and information technology;
- supporting professional learning and practice for school-based numeracy leaders and facilitators;
- developing local and regional communities of professional practice;
- initiating support for the mathematics and statistics learning area and its three strands: Number and Algebra, Geometry and Measurement, and Statistics;
- 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;
- promoting and encouraging access to PPTA study grants for postgraduate studies in mathematics;
- continuing to support mathematics coaches for year 6–8 teachers.

	Evaluators and Papers
Overall, the Secondary Numeracy Project (SNP) continues to have a positive impact on student achievement in year 9. Significant shifts were achieved in raising the proportion of the student population rated at the top stages of all domains of the Number Framework. The differences in end-of-year performances between year 9 and year 10 students were small.	**Andrew Tagg and Gill Thomas** *Performance of SNP students on the Number Framework*
In two year 11 numeracy-related achievement standards, there was a very modest improvement in achievement for SNP students in one and little difference in the other. Further investigation is needed, including an examination of student achievement in unit standards and other aspects of the NCEA course structure.	**Roger Harvey** *An investigation into the impact of the Secondary Numeracy Project on student performance in two NCEA Level 1 mathematics achievement standards*
Many teachers applied their year 9–10 SNP experience to their year 11 mathematics classes, with more impact on students in classes that focused on unit standards than on students in classes that focused on achievement standards.	**Roger Harvey and Derek Smith** *Teachers' views on the impact of the Secondary Numeracy Project on the teaching of year 11 classes*
The trial of a written strategy stage assessment tool (WSSAT) was consistent in assigning stages, but the WSSAT stages did not match the stages of a numeracy-based oral assessment tool developed for use in this research. (Further WSSAT development work is continuing.)	**Gregor Lomas and Peter Hughes** *Written and oral assessment of secondary students' number strategies: Developing a written assessment tool*
Links between the level of strategy used to solve linear equations and the student's numeracy stage on the Number Framework indicate that prerequisite numeracy may need to be considered when designing teaching programmes for algebra.	**Chris Linsell** *Solving equations: Students' algebraic thinking*
Kaiako (teachers) reported growth in confidence, in content and pedagogical knowledge, and in te reo pāngarau. Students of kaiako in the support project showed impressive achievement gains. Kaiako also identified characteristics that were important for Te Poutama Tau facilitators to have when working with wharekura teachers.	**Pania Te Maro, Robin Averill, and Joanna Higgins** *Evaluation of support for pāngarau teachers working in wharekura*

MINISTRY OF EDUCATION RESOURCES

2008 Ministry of Education resources include:

New **Figure It Out** student books with Answers and Teachers' Notes:
Financial Literacy (distributed November 2007)
Levels 2–3: *The Real Cost of Pets*
Level 3: *Saving for a Holiday*
Levels 3–4: *Granny's Gift*
Levels 4–4+: *Young Entrepreneurs*.

Statistics revision (to be distributed early December 2008) of levels 2–3, 3, and 3–4, in line with the achievement objectives of the mathematics and statistics learning area of *The New Zealand Curriculum*.
Statistics theme books (media), levels 2–3+ and 3+–4+, to be distributed March 2009.

NDP Book 7: Teaching Fractions, Decimals, and Percentages: Revised edition 2008: Draft
Book 7 has been revised to provide more support for the effective teaching and learning of fractions, decimals, and percentages. New activities have been added, along with key mathematical ideas and key knowledge at the beginning of each activity.

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 they are planning Home–School Partnership: Numeracy sessions.

TKI
Literacy and Numeracy community: www.tki.org.nz/r/literacy_numeracy
Mathematics community: www.tki.org.nz/e/community/maths

BES
The *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

nzmaths website:

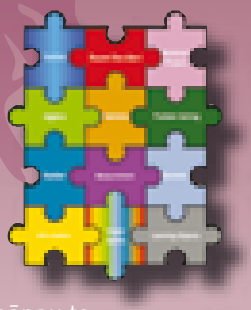
Earlier research and evaluation reports and compendia:
www.nzmaths.co.nz/numeracy/References/reports.aspx

Expectations of student achievement for years 1–8
These show the numeracy stages and curriculum levels expected by the end of each year level, including 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/numeracy/lead_teacher/plc/expectations/index.aspx

Mathematics/Pāngarau units of work
www.nzmaths.co.nz/units.aspx

Mathematics/Pāngarau learning objects
www.nzmaths.co.nz/LearningObjects
www.nzmaths.co.nz/maori/Lo/default.aspx

Numeracy Development Projects resources
www.nzmaths.co.nz/numeracy/index.aspx
www.nzmaths.co.nz/maori/index.aspx



Family section
This section on the nzmaths website provides information and activities for parents and whānau to help them support their children's learning. It includes activities to work on together at home.
www.nzmaths.co.nz/families/index.aspx

Further information relating to the contents of this pamphlet can be obtained from your nearest Numeracy Project co-ordinator. For names and email addresses, go to: www.tki.org.nz/r/governance/prof_learn/numeracy_e.php

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Additional copies of this pamphlet are available free on request and can be ordered through Ministry of Education Customer Services on freephone 088 660 662, freefax 0800 660 663, email: orders@thechair.minedu.govt.nz or online at www.thechair.minedu.govt.nz

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