Success for Underachievers: How Do They Get It?

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Although the New Zealand Numeracy Development Project has contributed toward achievement successes for many students there still remains a large gap, by OECD standards, between students whose achievement is as expected and students whose achievement is of concern. This gap then extends further to the identified tail of underachievement. For those who are underachieving the cycle could continue throughout their schooling. This paper reports on a new initiative and advocates for a more structured approach for some children, alongside the constructivist and co-constructivist approaches their teachers employ. Of interest is the successful work undertaken with underachieving students by parent volunteers in a primary school.

Introduction

The New Zealand Numeracy Development Project (NDP) was introduced in 2001 to raise student's levels of achievement in mathematics through improving teachers' professional knowledge, skills, and confidence. This reform was in response to the poor performance of New Zealand students in the Third International Mathematics and Science Study (Garden, 1997). Several pilots have since been trialled and today the project includes work in schools for years 1-8 children; a secondary component for years 9-10; and Te Poutama Tau an initiative in Maori.

The NDP has shown through evaluations and research findings that student's achievement is improving as is the quality of teaching and learning in mathematics in New Zealand schools (Ministry of Education, 2004). However there also continues to be a large tail of underachievement (Wylie, 2003).

With an emphasis on building a knowledge-based economy government priorities are clearly focussed on raising student achievement and on closing the gap between the group of underachieving students and those whose achievement is as expected. The 'Competent Children at 12' study (Wylie, et. al, 2004) suggested that if a student was in the bottom quartile of achievement at age five, it was likely they would still be achieving below the median by age 12, unless there is appropriate intervention in the following three years,. Students can become stuck in bottom group ruts and equally concerning is the student whose achievement is of concern who can plateau in their progress and therefore regress as to their position of understanding on the number framework – within two years that student would have moved from one who's achievement was of concern to being one who's potential for success was seriously disadvantaged.

Results from the NDP national database for 2006 showed that at year six 28% of the students achievement was "at risk" or "cause for concern"; at year seven 26% and at year eight a staggering 46%. The 'at risk' group included those students whose achievement was below the national expectations by such a degree that their future learning in mathematics was perceived to be in jeopardy. The students identified as having achievement that was 'of concern' were operating at a stage just below the national expectation for their year group.

The percentages are from a longitudinal study of 7,400 children by Tagg and Thomas (2007). The student's progress, in that particular study, from 2002 – 2006 was tracked and results collected every year since their schools had completed the initial three years of the NDP professional development. Analysis of data is a guide for schools to decide appropriate expectations for their students.

In R. Hunter, B. Bicknell, & T. Burgess (Eds.), *Crossing divides: Proceedings of the 32nd annual conference of the Mathematics Education Research Group of Australasia* (Vol. 1). Palmerston North, NZ: MERGA.

When students do not seem to be learning it seems pointless to continue teaching in the same way – ‘‘if we always do what we've always done, we will get what we've always got[1]’. Anthony and Walshaw (2007) suggest that “…the task ahead is to change patterns of underachievement that, in the past have been connected to a range of factors” (p 10). Trends identified with students in year 6-8 (aged 10-13) deemed ‘at risk’ or ‘cause for concern’ are poor recall of basic facts, little understanding of place value, and poor counting skills forward and backwards beyond 100 (Tozer, L., personal communication, February 23, 2007).

Targeted Learning Groups Project

In an effort to attend to the underachieving students’ dilemma, five Otago and Southland schools implemented a small pilot project Targeted Learning Groups (TLGs) in 2007. The aim of these projects was to raise children’s knowledge of number and to assist with their developing number strategies. To be numerate flexible thinkers, children need both knowledge about the structure of numbers, and strategies to operate on numbers. The initiative was borne from an idea by Holmes and with another facilitator (Anne Lamond) has been developed for schools use. Students participating in the pilot were thirty-two year 6 – 8 students (NZ) whose achievement was identified as being a ‘cause for concern’. The purpose was to move counting-on students to be secure in part-whole thinking at Stage 5 (NZ Framework), and corresponding knowledge.

The project also aimed to improve the children’s number knowledge through numeral identification, counting forwards and backwards, place value, and basic facts and was modeled and delivered in a similar way to the New Zealand Reading Recovery Programme. Essentially sessions for each student had to be consistent, attended every day, and follow a common format e.g. counting forwards and backwards with an emphasis on counting by incrementing in tens. Beishuizen and Anghileri (1998) argued that lower attaining children usually use a ‘split method’ that involves using tens and ones and that they are more likely to make errors by using that strategy.

A typical session would closely follow the outline below taken from a teacher aide’s plan:

- Counting backwards and forwards - start at 4 and count in 10s, count in odd numbers from 11 to 51 and back again
- Order numbers – children to take ten 3 and 4 digit numbers and order from smallest to largest
- Saying (reading) numbers – read their ordered numbers aloud
- Dictation – 2, 3, and 4 digit numbers – children write numbers and words
- Basic Facts – practice doubles and halves
- Revision – near doubles strategy, 10 + 10, 10 + 11, 10 + 9
- Revision - known game of multiplication 2x
- Introduce new game – not today
- Check – children to check their own list
- Set homework - count forwards and backwards in 3s from 9 - 42

The students involved in the TLG pilot attended sessions five days a week for 30 – 45 minutes with teacher aides. A group of four children was considered the maximum at each time. Classroom teachers along with the numeracy facilitator interviewed the children using the NDP diagnostic interview (Ministry of Education, 2007b) on entry and exit of a five week period. After a break of five weeks the students returned for another five weeks work. Some children did not require a second term. Teacher aides had their own resource

[1] Adam Urbanski

booklet plus their own materials and after an initial time with the outside facilitator were able to work independently. Any tasks in their resource booklet were chosen to help develop and strengthen the number knowledge necessary to support the development of part – whole thinking. Students were encouraged to monitor their own progress through a series of four check charts. Chart A deliberately contained three items so that students could gain some success quickly. When students knew they were secure with an item they could tick under self. After that their teacher or the teacher aide had to notice it three times before they gained a star. Three stars, in this case, would earn a certificate.

Chart A.

Targeted Learning Group self monitoring progress sheet

Name: I can:	Self	Teacher/ Teacher Aide	Teacher/ Teacher Aide	Teacher/ Teacher Aide	Star
Count in ones forwards and backwards starting from any number up to 50					
Identify numbers 1 – 10 on the tens frames instantly					
I can read and write 2 digit numbers up to 100					

Teachers, teacher aides, and other volunteers working with children paid close attention to the work of Mason (2005) through deliberate acts of teaching by directing attention of the children to the tasks. This necessitated being aware of the structure and focus of their own attention so they were able to direct the attention of the learners (Mason, 2005). Teachers gained this ability through training in the numeracy project and numeracy booklets and teacher aides through training by numeracy facilitators and with a specially prepared resource.

Students' results from the TLG in 2007 showed their improvement in counting skills and place value led to improved performance in numeracy and confidence in their own ability. With the success of the students' results in the pilot two other outcomes of importance have arisen: a) several numeracy facilitators have adapted the work and have had success in their own regions and, b) the people making a difference are teacher aides, volunteer parents, grandparents, older brothers or sisters, or more able peers.

The following case study has been adapted from the original TLG model juxtaposed with Home School Partnership in Numeracy. Anthony and Walshaw (2007) stress there is a shared belief that building home-community and school-centre partnerships is fundamental to effective teaching and enhances children's learning.

> Building harmonious relationships between school, families and communities can have reciprocal benefits for all concerned. Parents develop more understanding of the school's programme and appreciate their children's numeracy knowledge while home and community environments offer a rich source of numeracy experiences on which to base and enhance that learning in school (Ministry of Education, 2008, p. 3).

That belief underpins the following case study.

Case Study: PHINK – (Parents Helping Increase Number Knowledge)

Kia mahia tatau tahi ma te paiinga a a tatau tamariki.
May we all work together for the good of our children

Background

Early in Term One 2008, the students at Pacific School (pseudonym) invited their families and members of the schools wider community to a Mathematics Evening and to bring along mathematics games and activities from home to play. The students were also prepared to teach the games and activities that they had been learning at school. The aim of this evening was twofold, firstly to 'reinforce and endorse what families and parents are already doing for their children' (Ministry of Education, 2008, p.4) and secondly to introduce parents to the mathematics that was happening at Pacific School and increase their understanding of numeracy. Parents and students were provided with the opportunity to share in 'a rich source of numeracy experiences' (Ministry of Education, 2008, p.3). Through-out the evening the parents and community members were introduced to effective ways of teaching mathematics and supporting their children at home with learning number knowledge: forward number word sequences, backward number word sequences, fractions, place value, and basic facts (Ministry of Education, 2007a). Each family was given a take home pack that included copies of the games they had played, a pamphlet outlining the number framework and required knowledge at each stage, and useful links to websites.

At the end of the evening the PHINK (Parents Helping Increase Number Knowledge) project was introduced, parents were invited to volunteer to work with a group of students whose mathematics achievement was seen to be 'at risk' or 'of concern'. Sixteen parents from Pacific School indicated their interest in participating in the project.

Method

Learning and development sessions were facilitated by the second author three times a term for the PHINK tutors. The initial focus for these sessions was on extending the PHINK tutors knowledge and understanding of the number framework (Ministry of Education, 2007a). This was achieved through their active participation in games and activities, through observing and co-teaching lessons (Roth & Tobin, 2002) with the advisor and fellow PHINK tutors, and, where identified, the opportunity to consolidate their own mathematical knowledge. The focus of these sessions soon shifted to discussions centered on student achievement, social influences on learning, and effective pedagogy – particularly the need for effective questioning.

Assessment occurred before the beginning of the project, after ten weeks of the project, and after 20 weeks of the project. These are shown as test time 1, 2, and 3 in the findings. The statistical package 'R' was used to create the box plots for each knowledge domain which are discussed fully in the findings section.

Participants

This case study includes the 28 students from Pacific School who participated in the PHINK project for 20 weeks. Their demographic data is shown in Table 1.

Table 1
Pacific School PHINK Project Students demographic data

Year Group	Gender		Ethnicity			
	Boys	Girls	NZ European	NZ Maori	Pasifika	Asian
Year 3 (n=5)		5	4		1	
Year 4 (n=4)	2	2	4			
Year 5 (n=12)	5	7	9	2	1	
Year 6 (n=7)		7	4	1	1	1
Total (n=28)	7	21	21	3	3	1

Organisation

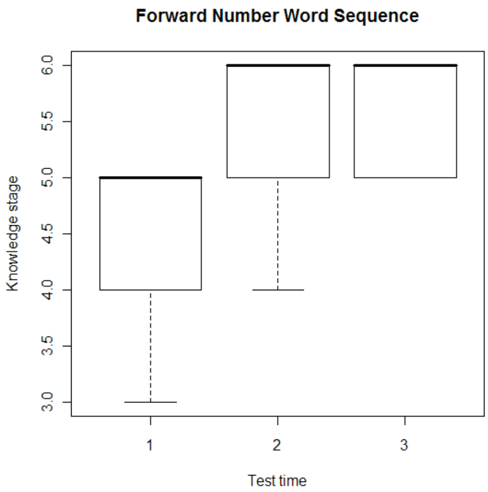
Students whose knowledge domain achievement was evidenced as being ‘at risk of underachievement’ or potentially ‘of concern of underachievement’ - according to their Diagnostic Interview (Ministry of Education, 2007b) results - were nominated by classroom teachers and selected by the PHINK lead teacher in consultation with parents, classroom teachers, and the principal. The selected students were re-interviewed using an impartial assessor to both moderate and validate their results. Students were put into groups of four within a similar range of achievement, taking into consideration gender and other social issues.

Description of Intervention

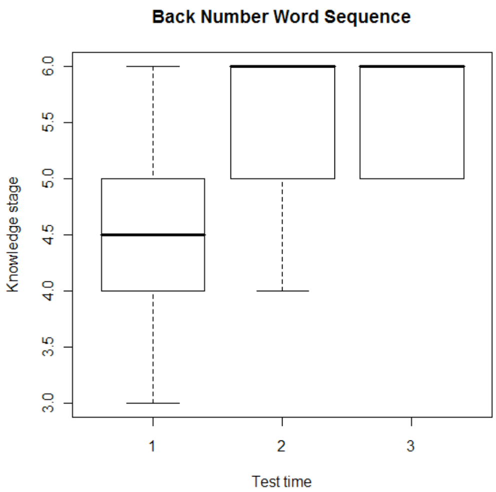
A room was set up at Pacific School as the PHINK room and visual aids and support materials were placed on the walls. A budget that would cover equipment and stationery costs that was specifically for the PHINK room, students, and tutors was agreed upon. Tutors developed a PHINK folder which included the protocols, roles, and responsibilities for those involved, an extended check-list of the expectations for achievement within each stage, and possible questions for eliciting thinking.

The PHINK tutors co-taught in pairs with groups of no more than four children and the students spent 20 weeks (Term Two and Three) on the project. Students attended PHINK sessions of 30 minutes at least four times a week over and above their normal maths time in their classrooms. At the end of the third term the students were assessed using the Individual Knowledge Assessment of Numeracy (IKAN). This assessment was to measure growth in achievement, and the students were assessed again at the end of the fourth term to measure retention of achievement.

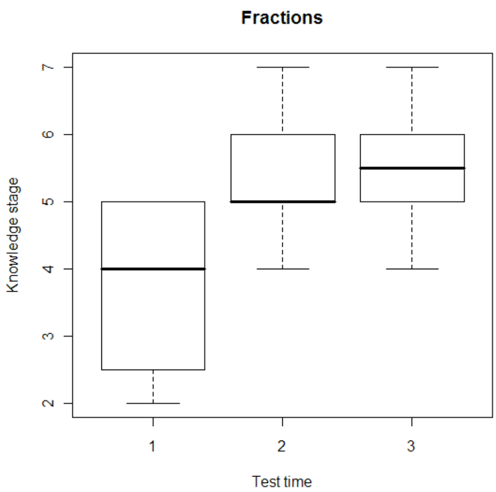
Findings



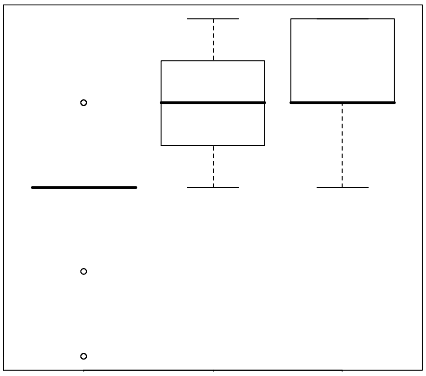
The initial assessment of the students (n=28), taken before the project began, showed that their forward number word sequence knowledge ranged from stage 3: numbers to 20 to stage 5: numbers to 10,000. By the second assessment, at the end of the first ten weeks on the project, the spread had improved to stage 4: numbers to1,000 to stage 6: numbers to 1,000,000. The spread had improved again by the final assessment, after 20 weeks on the project, with all students operating at either stage 5: numbers to 10,000 or stage 6: numbers to 1,000,000. The median achievement for the group had also increased from stage 5 to stage 6.



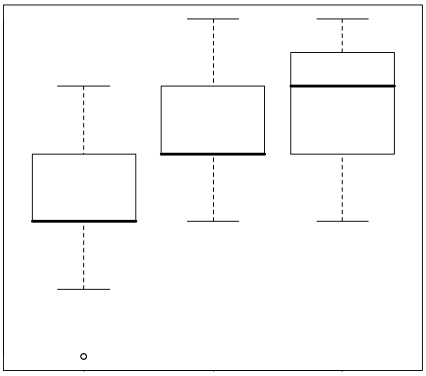
The backward number word sequence of the students ranged from stage 3: numbers to 20 to stage 6: numbers to 1,000,000 at the time of the first assessment. By the second assessment the range was stage 4: numbers to 1,000 to stage 6: numbers to 1,000,000 and by the third assessment, as with the knowledge area, the tail has disappeared and the achievement is within stage 5: numbers to 10,000 and stage 6 with the median increasing from between stages 4 and 5 to stage 6.



In the knowledge domain of fractions the students achievement ranged from stage 2: does not recognise common fractions to stage 5: orders fractions at the time of the initial assessment. By the second assessment there were no students at either stage 2 or 3 with the range now being stage 4: records and recognises common fractions to stage 7: equivalent fractions. Whilst the range stayed the same after the third assessment – the median had moved from stage 5 in the second assessment to between stage 5 and 6 for the third.



The first assessment for place value showed that the majority of the students (n=25) were operating at stage 4: groupings of and within 10 with one child each operating at stages 2, 3, and 5. At the time of the second assessment the range of achievement was stage 4 to 6: groupings of and within 1,000. This remained the same for the third assessment with the median also remaining at stage 5: groupings of and within 100.



The students were operating within a range of stage 3: addition and subtraction within 5 to 6: addition and subtraction to 20 and multiplication and division to 10 times 10 for their basic facts knowledge at the time of the first assessment. By the second assessment the range of achievement was stage 4: addition and subtraction to and from 10 to stage 7: divisibility rules and factors and this remained the same following the final assessment after the 20 weeks of the project. However the median for basic facts achievement improved from stage 4 to 5 and then 6 over the 20 weeks of the project.

Conclusion and Implications

This project has attempted to *not do what we have always done* but instead has explicitly planned to do something different for those students whose mathematical achievement was identified as being at a level that meant their potential for success was at risk or of concern. The at risk and of concern mathematics achievement of targeted students has been placed at the heart of teaching and learning programmes which in turn have been supported by all members of the school communities – principals, lead numeracy teachers, classroom teachers, teacher aides, parents, whanau, numeracy facilitators and most importantly the student themselves. The responsibility for student achievement has been recognised as a collective enterprise and therefore has ensured that additional workloads do not become onerous for any one individual.

It can be hard working with students who believe numeracy is hard. Empowering students though building their confidence and knowledge of number has been achieved by the TLG and PHINK projects. Underachieving students who were in the project for 5, 10 or 20 weeks all enjoyed some success. Thomas and Tagg (2008) have confirmed the urgency which the authors feel is most important and that is, that students who are performing below expectations must have accelerated learning.

Implications that have arisen from this study are that the long tail of achievement can be shortened and that the concept is not difficult to organise and manage. Good news for many busy classroom teachers and students whose mathematics achievement is of concern, or at risk.

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