Proceedings of the

'Narrowing the Gap: Addressing Educational Disadvantage' Conference

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Narrowing the Gap

Addressing Educational Disadvantage

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SiMERR National Conference
University of New England,
Armidale NSW

26 – 28 April 2007

Proceedings Edited by:
Lorraine Graham

SiMERR

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The National Centre of Science, Information and Communication Technology and Mathematics Education for Rural and Regional Australia

Proceedings of the Narrowing the Gap: Addressing Educational Disadvantage Conference

Edited by: Associate Professor Lorraine Graham, University of New England

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The Narrowing the Gap: Addressing Educational Disadvantage Conference was held at The University of New England, Armidale, New South Wales, Australia from 26 – 28 April, 2007.

FOREWORD

ADDRESSING EDUCATIONAL DISADVANTAGE: INTRODUCTION TO THE *NARROWING THE GAP* CONFERENCE PROCEEDINGS.

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As Chair of the Narrowing the Gap Conference Committee, I would like to thank all members of the committee (John Pegg, Deb Jenner, Russel Glover, Jenny Thomas, Noelene Raymond, Tony Brown and Sharon Gallen) who worked so hard to make the conference such a success. Director of SiMERR, John Pegg was instrumental in envisioning, planning and supporting SiMERR Australia's Student Diversity Hub representatives to attend Narrowing the Gap. Deb Jenner kept the conference organisation on track and worked capably alongside Sharon Gallen, manager of the UNE Conference Company. Tony Brown developed the website and tackled the complex job of providing ICT support for the three days of the conference. All members of the committee, but especially Deb Jenner, Russel Glover and Debbie Sozou made the Narrowing of the Gap conference very special by providing the extra touches of hospitality that set this important gathering apart.

To recap, the Narrowing the Gap Conference held at the University of New England from the 26th to 28th April 2007 brought together practitioners, academics, and administrators concerned with the conference theme of Addressing Educational Disadvantage. National and international keynote speakers elaborated on different aspects of this theme in their presentations.

Professor John Hattie discussed the major findings and practical implications of his extensive meta-analyses of educational research. The key concepts he elaborated on included teachers' conceptions of learning, the power of feedback, and multiple notions of achievement. In his address, **Professor Mike Royer** highlighted the critical role that efficient use of working memory plays in academic achievement. He pointed out that low-level aspects of academic skills such as reading, writing, and mathematics can become automatic and that virtually all higher-level academic learning is dependent on these automated low-level skills. Professor Royer also discussed how the development of automated cognitive skills can be blocked by individual differences in cognitive capacity, variation in world languages and poor instructional practices.

Whether education is failing to live up to its promise for many young people was the quandary posed by **Professor Geoff Masters** in his address. In his presentation, Professor Masters focused on two related concerns for Australian education: (i) the significant proportion of young people who become disengaged during their school years, achieve only minimal educational outcomes and have limited subsequent engagement in work or further learning; and (ii) the shortage of young people with the knowledge and skills required for effective participation in the future Australian workforce. Regarding such essential educational skills, **Professor Ian Hay** and **Professor Adrian Ashman** presented complementary keynotes on the importance of language skills to children's early reading acquisition and models of recreational reading and engagement, respectively. Lastly, **Professor John Pegg** and I gave the final keynote presentation that focused on ways to improve the performance of low-achieving students and described some key features of the *QuickSmart* intervention which targets students who consistently experience a lack of success with basic academic skills.

Alongside these international keynote speakers were 28 paper and symposia presentations delivered by presenters from the United Kingdom, New Zealand and throughout Australia. The papers included in this book of proceedings were written based on authors' conference presentations and have been successfully peer reviewed. Several established publishers have also been approached to support an edited book based on the major research themes presented at the Narrowing the Gap conference.

The ten papers included in this book of conference proceedings have all been peer reviewed in accordance with Department of Education, Employment and Workplace Relations regulations for Higher Education Research Data Collection. (http://www.dest.gov.au/sectors/research_sector/online_forms_services/higher_education_research_data_collection.thm#2008_specifications). All authors have responded to reviewer comments in a professional and collegial manner.

As editor of the proceedings, I am very pleased to recommend this collection of papers to you.

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The National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) is funded by a Regional Partnerships Program grant through the Department of Transport and Regional Services (DOTARS). SiMERR wishes to gratefully acknowledge this funding, which underwrites the *Narrowing the Gap* conference.

SiMERR also wishes to thank the following organizations for their support of the conference.

Australian Council for Educational Research
The Australian Council for Educational Research (ACER) provides state-of-the-art educational research, products and services. ACER's mission is to create and disseminate knowledge and tools that can be used to improve learning.

ACER displayed its quality products in Room 108, ground floor, Education Building during the Narrowing the Gap Conference.

Further information on ACER can be accessed on the web at:
http://www.acer.edu.au

Educational Experience
Educational Experience specialises in supplying toys and educational products to Preschools, Schools and Child Care Centres throughout Australia. The company was established in 1977 and is now Australia's leading school supply company.

Educational Experience also displayed its quality products in Room 108, ground floor, Education Building during the Conference

Further information on Educational Experience can be accessed on the web at:
http://www.edex.com.au

MAC1
MAC1 is a computer reseller that provides computer software and hardware services to UNE. During the conference, MAC1 provided participants with complimentary access to internet services at their shop in the IT Building during the Narrowing the Gap Conference.

Further information on MAC1 can be accessed on the web at:
http://www.mac1.com.au/

Sponsored by:

THE NATIONAL CENTRE OF SCIENCE, INFORMATION AND COMMUNICATION TECHNOLOGY AND MATHEMATICS EDUCATION FOR RURAL AND REGIONAL AUSTRALIA (SIMERR)

SIMERR NATIONAL CENTRE

The National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) was established in July 2004 with a core grant of $4.95m from the Department of Transport and Regional Services (DOTARS) through the Regional Partnerships Program.

VISION

SiMERR Australia works with rural and regional communities to achieve improved educational outcomes for all students in the areas of Science, Information and Communication Technology (ICT) and Mathematics, so that:

- Parents can send their children to rural or regional schools knowing they will experience equal opportunities for a quality education;
- Students can attend rural or regional schools realising their academic potential in Science, ICT and Mathematics; and
- Teachers can work in rural or regional schools and be professionally connected and supported.

MISSION

We will support student achievement and enhance teacher growth in rural and regional areas through research, pre-service, in-service, community and overseas programs by working collaboratively with communities, educational authorities, professional associations and industry groups to develop solutions to problems faced by teachers, particularly those who are professionally isolated.

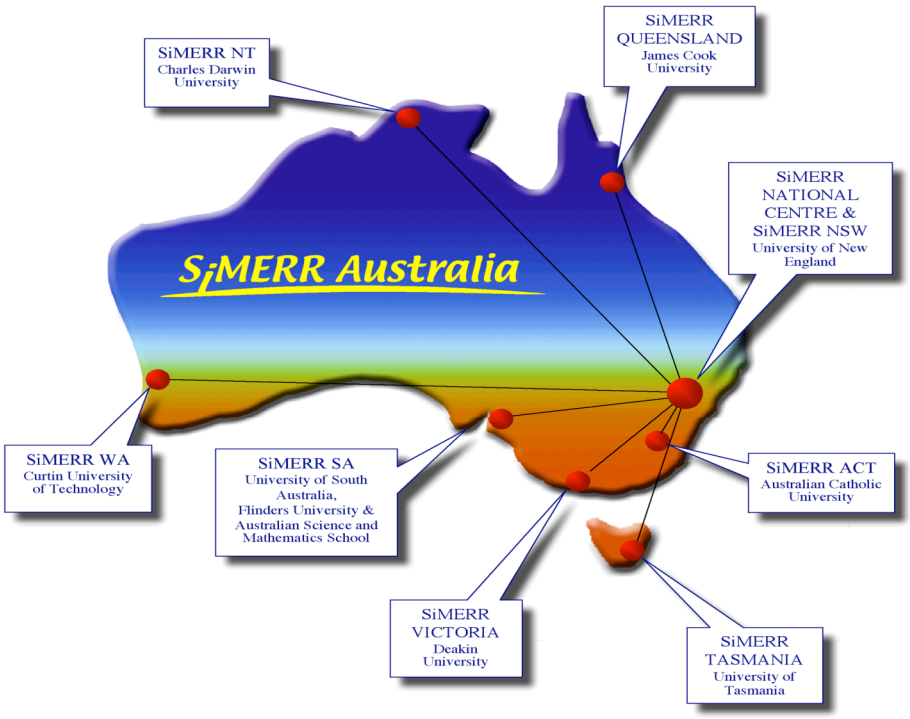
PURPOSE

The purpose of SiMERR Australia is to provide a national forum for addressing issues relating to the key areas of Science, ICT and Mathematics education, particularly as they concern rural and regional communities. Through a combination of strategic research, network building and practical support, SiMERR Australia aims to identify the needs of geographically and professionally isolated teachers, and enhance their efforts to assist students to realise their academic potential in these subject areas.

To achieve this purpose the SiMERR National Centre, located at the University of New England, comprises a team of professionals with extensive experience in science, ICT and mathematics education, expertise in many areas of student diversity, excellent administration and project management skills, and a successful track record in conducting large-scale research projects.

In order to be a truly national centre, however, SiMERR Australia has established a Hub in each state and territory. These Hubs work together with the SiMERR National Centre in establishing links with teachers, education providers and relevant professional and community organisations within their own state or territory, and identify research opportunities and priorities. Hub teams are also responsible for developing a network of researchers within their state or territory involved in Science, ICT and Mathematics education, and in aspects of student diversity in these subject areas.

Hubs of SiMERR Australia



SiMERR places a high priority on collaborative partnerships as a means of extending and deepening its national reach. This networking strategy leverages the work of the National Centre, opening new opportunities for independent and collaborative projects. It builds on the existing networks and capabilities of the partner organizations enabling projects to be initiated which otherwise would be beyond the capacity of the National Centre. It also attracts additional resources from partners working in the areas of science, ICT and mathematics, and channels these to specifically address the needs of rural and regional students and teachers.

SiMERR now has ongoing links and collaborative activities with:

- ACT Department of Education and Training
- Australian Council for Computers in Education
- Australian Association of Mathematics Teachers
- Australian Science Teachers Association
- Australian Science Innovations
- Australian Curriculum Studies Association
- Catholic Schools Office
    - Diocese of Armidale
    - Diocese of Lismore
    - Diocese of Port Pirie
- Department of Education and Training (DET) NSW
    - New England Region schools,
    - North Coast Region schools,
    - Western Region schools
- New England Mathematical Association
- Northern Territory Department of Employment, Education and Training
- NSW Institute of Teachers
- Primary Science Matters
- School of Education, University of New England
- Teaching Australia
- Zonta

Contents

REFEREED CONFERENCE PAPERS

RĀPP: TAPE-ASSISTED READING TO SUPPORT STUDENTS' LITERACY IN MĀORI IN TWO BILINGUAL SCHOOLS

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Abstract

In 2006 a literacy project that aimed to raise the reading achievement of Māori students in two New Zealand bilingual schools was conducted using a tape-assisted reading resource for students learning to read in the Māori language (te reo Māori), called Ripene Āwhina ki te Pānui Pukapuka (RĀPP). This paper presents the findings of this trial from the two schools. One school encouraged students to use the resources with family members for two terms in their homes and one school maintained the program in the school for two terms. Pre- and post-test assessments of reading levels were carried out in the two schools revealed that both student groups had made considerable reading gains

PREVIOUS RESEARCH AND CURRENT CONCERNS

In recent years research has begun to investigate ways of improving students' literacy in Māori language immersion settings, in both kura kaupapa Māori (schools designed by Māori for Māori to uphold and present authentic Māori values and beliefs) and within bilingual classes in mainstream schools (Berryman, Glynn & McDonald, 2004; Cooper et al., 2004; Rau et al., 2001). These studies have addressed students' reading, writing or oral language, either separately or in combination, and have also focussed on developing and trialling resources to improve both assessment and teaching strategies. The majority of studies reporting positive outcomes from specific teaching strategies for reading and writing in Māori have employed the one-on-one reading tutoring program Tatari Tautoko Tauawhi (Pause Prompt Praise), either alone or in combination with other literacy interventions (Berryman, Glynn & McDonald, 2004). Overall research to date has provided teachers and parents in Māori immersion settings with some evidence-based findings that demonstrate the effectiveness of particular strategies for measurement and assessment of students' literacy progress.

There remains, however, a particular concern. Because of past and continuing colonisation of Māori within the New Zealand education system many of today's Māori parents, while keen for their children to become literate in Māori, do not have the Māori language competencies or confidence to assist their children learning to read Māori. Research with strategies such as Tatari Tautoko Tauawhi clearly demonstrates that parents and whānau members can learn to implement these tutoring strategies successfully (Berryman, & Glynn, 2003), however, effective tutoring requires a good level of Māori language competence or support to tutors. Hence, it is important to explore other strategies that parents with limited Māori language, but a strong commitment to help their children, might be able to implement at home.

PRECURSOR TO RĀPP

One promising strategy in this respect is a strategy known in English medium as Tape Assisted Reading Program (TARP) (Medcalf, 1996; Medcalf, Moore & Medcalf, 2003). TARP is designed to assist students to increase their 'reading mileage', that is the total amount of time they spend engaging with reading texts of appropriate difficulty. TARP achieves this by providing audiotapes of student texts being read by accomplished readers who provide models of competent and lively oral reading. Students are supported to select tapes of appropriate difficulty level and interest which they can listen to as many times as they like through individual head-phones, while following the text carefully, until they feel competent and confident enough to read the text independently. Studies employing TARP have demonstrated strong positive outcomes for students learning to read in English (Medcalf, Moore, & Medcalf, 2003). The effectiveness of TARP seems to depend on simultaneous provision of competent oral/aural reading and visual text in the context of meaningful subject matter.

Given the increased availability of high-quality reading materials in Māori, and the need to focus on the range of students in Māori immersion settings, especially those with limited language and literacy skills, there appeared to be benefits from exploring reading support strategies that could be easily implemented at home as well as at school, and by parents with limited Māori language. The present study therefore sought to explore the effectiveness of the TARP strategy to increase students' reading practice or reading 'mileage' with Māori language texts. Accordingly, the TARP strategy was adapted as RĀPP (Ripene Āwhina ki te Pānui Pukapuka, tape assistance to read books), and a series of 100 Māori language stories, covering eight reading levels from within the Ngā Kete Kōrero framework (Ngā Kete Kōrero Framework Team, 1996) were read onto tapes by fluent native speakers including elders. Previous research had demonstrated that because of the phonemic regularity of the Māori language, measures of children's reading competence based on accuracy and fluency alone tended to over-estimate levels of reading comprehension (Ngā Kete Kōrero Framework Team, 1995). Therefore, two comprehension activities were prepared to accompany each book and tape. This involved a set of two cloze cards, (kupu whakaurunga) and a 'three-level guide', providing three levels of questions to guide readers in their understanding of the text (ngā puawaitanga). The tape resources and the comprehension activities together provided opportunities for teachers to monitor and for students to self-manage (initiate, monitor and record) their own reading progress within and across reading texts. They also provided specific activities for family members at home to engage in and support their children's learning to read in Māori.

PARTICIPANTS

The research was instigated by the principals of two primary schools, who were actively seeking support to assist students having difficulties with learning to read in Māori. Both principals signalled an interest to work jointly within their schools as well as with the families of their students.

School 1 has 293 students on the school roll (Years 1 to 6 students). In this school there are two bilingual classrooms with students accessing the curriculum through both Māori and English. The RĀPP intervention was carried out with students from these classrooms.

The ten students from Years 2 and 4 who were identified by the teacher for participation in the program were found at baseline to cover a wide range of reading ability with some students working at a developing reading stage (level 8: kete kiekie e) and others working at an almost fluent reading stage (level 21: kete pīngao o). All 10 selected students completed assessments for baseline, intervention and non-program time frames.

School 2 has 259 students (Years 1 to 8) learning in bilingual classrooms. In this school students were chosen on the basis of an identified need to develop confidence to read as well as their need to develop reading skills. The baseline reading levels for these students all fell within the developing reading stage (level 6: kete kiekie a, to level 10: kete kiekie i). Twenty one students from Years 2 and 3 were identified for participation in the program. At the completion of the study 18 of these students had both baseline and intervention data available for the final analysis.

METHOD

Pre and post testing points across each group of students were established and the RĀPP data were analysed largely in terms of pre-post (baseline – intervention) comparisons. Interviews were also conducted with both principals and with teachers and students in both schools.

ASSESSMENT PROCEDURES

In the main, because many Māori medium students are not learning the Māori language from birth, Māori medium education now tracks reading attainment through the series of ascending reading levels found within the Ngā Kete Kōrero framework rather than by reading ages (Ngā kete Kōrero Framework Team, 1996). Within this framework there are a series of five reading stages from pre emergent reading to fluency: harakeke (pre emergent); kete harakeke (emergent); kete kiekie (developing reading); kete pīngao (developing fluency); miro (fluency). Within each stage there are a number of ascending levels of difficulty. These levels are shown using the ascending vowel letters e.g. kete kiekie a, kete kiekie e and so on.

The following assessment procedures used a consistent range of 21 texts, selected to cover the ascending levels in the Ngā Kete Kōrero framework.

1. **Preview of text.** The researcher began the session with a brief discussion of the story relating it to the reader's experience. Students were then given three minutes of uninterrupted time to read the story silently themselves before being asked the oral recall question component of the oral comprehension.

2. **Three-minute Māori oral reading sample.** A three-minute, audiotape sample of oral reading from a text at their appropriate instructional level was taken for each student. Samples were analysed first for book level, then for accuracy, and then for correct and incorrect reading rates (number of correct and incorrect words per minute).

3. **Oral comprehension.** This was assessed in terms of a combined score on two tasks:

(a) *Oral recall questions.* Following the silent reading section, students were asked three related oral questions. If they could not answer any of the questions correctly the researcher chose another book at an easier level. If they got at least one correct answer the assessment was continued with the three minute oral reading at that level.

(b) *Oral cloze task.* Following the oral reading, a section of the identical level text with target words blanked out was presented as a cloze card. The researcher read the cloze card to the student who was asked to supply words that would fit in the gaps. Exact words (the exact word used in the text) and appropriate word substitutions (words that retained meaning within the text) were accepted. These two oral comprehension scores were combined.

Reading assessments continued until students reached the maximum book level at which they could still read at an instructional level. This was determined each time by any two of the following three criteria. These criteria began to emerge as part of the Ngā Kete Kōrero research and have been retested in subsequent Māori literacy research:

- Reading accuracy level of 90% or higher;
- Correct reading rate of 21 words or more per minute; or
- Combined oral comprehension score of 41% or more.

RESULTS

School 1

Baseline data was gathered at the end of term one. The RĀPP program was implemented over term two and term three with assessments taken at the end of each school term. One further assessment point was taken at the end of the final school term, term four, to compare the progress achieved by the school literacy program alone. Due to the lead teacher having to take extended leave throughout much of term two and three (the terms targeted for the RĀPP program implementation) the RĀPP program was inconsistently applied in the classroom setting. However, the RĀPP program was continued by parents and families at home. Data from School 1 assessments, taken at baseline (term one), during two terms of the RĀPP program (term two and three) and after ten weeks of the class program alone (term four), appear in Table 1.

Table 1: Shifts In Students' Reading At School 1

School 1				
Students n=10	**Baseline**	**1st RĀPP Program**	**2nd RĀPP Program**	**Class Program**
Book Level	**11.9**	**13.3**	**14.3**	**14.8**
Reading Accuracy	**95.5%**	**96%**	**96.5%**	**96.4%**
Correct Rate (Words per Minute)	**49**	**54.5**	**52**	**49.3**
Incorrect Rate (Words per Minute)	**1.9**	**1.8**	**2**	**2**
Comprehension	**72%**	**70%**	**67%**	**81%**

Book Level: Table 1 shows that, for the ten students in School 1, there was an overall increase of 1.4 book levels in the mean level of book read to accuracy and comprehension criteria between baseline and the first RĀPP program and a further one book level over the second RĀPP program. However, only 0.5 of a book level was shown after the RĀPP program was withdrawn and the students had returned to a term on class program alone.

Reading Accuracy (%): Even though increases in book levels occurred at each assessment point, thus students were reading more difficult texts, the high reading accuracy score shown at baseline (95.5%) was slightly improved with both program and post program assessments.

Correct Rate (correct words per minute): Again, with increases in book levels occurring at each assessment point, there were still increases in correct reading rate from 49 to 54.5 (5.5 correct words per minute) between baseline and the first RĀPP program. This reduced by 2.5 correct words after the second RĀPP program and reduced again by 2.7 correct words after returning to class program alone.

Incorrect Rate (incorrect words per minute): Table 1 shows that the increases in book levels that occurred at each assessment point were not compromised by reading more incorrect words per minute.

Comprehension (%): Table 1 also shows that while reading a book at a higher level of difficulty, comprehension between baseline and the first and second RĀPP program declined slightly (from 72% to 70% then to 67%) but with ongoing reading mileage this improved again to 81% at the final assessment point.

Implementing RĀPP
The teacher from School 1 talked about the specific aspects of RĀPP that she had liked.

> ***Teacher:*** *I like the program I can see how it would work effectively. I liked the monitoring book that the tamariki (children) could use to self assess themselves when they were ready to kōrero (talk) to an adult. I also liked the cloze activities. I liked the resource itself, everything being there to use. It's really straight forward and I can see the benefits. I liked the interaction with home, the kids were good and everything came back.*

The principal also commented on the positive interactions between school and home that were initiated by the RĀPP program. One of the important benefits she found was that once the parents had attended the training session they had continued to be involved with the school.

Students
When asked by the researcher how they thought listening to the tapes had helped them with their reading, students agreed that they had enjoyed the process and that it had helped them with their reading. They said:

> ***Tiare:*** *'Cause it was cool… because they were telling the story. By reading the book with it [it helped me to] read the story.*
> ***Rangi:*** *The way they sound the words out.*
> ***Kerry:*** *To read with it… helped me to read.*
> ***Huia:*** *I can read the book with it [the tape]. You can keep in time with it.*
> ***Terri:*** *Because it tells me the story. You could listen to them [the tapes] and read the book at the same time. Because it helps you read the books properly. You find out new words in the book.*
> ***Danny:*** *I liked listening to it and reading it and learning some more words.*

Teacher
The teacher talked about her enthusiasm for the resource and how she would use RĀPP in the future.

> ***Teacher:*** *I really think it is an effective program. Within our school I have got years 0 to 4 and that is why I found it difficult with them all at different stages to give them the quality time.*
>
> *I went for Ngāti Whakaue (tribal) funding for next year to ensure that I have someone in the middle block to run that program and pull the tamariki out of the classrooms, say a group of five for say 45 minutes doing their RĀPP mahi (work) and comprehension, just talking about the books.*
>
> *If I can get the support next year,* [I will] *train the kaiāwhina [teacher aide], get the parents on board and do five days a week slots, I think it will be great. So we have looked at it closely at the end of last term to see how we can really make it stand in the school. It's a stepping stone. This year was our first year* [using RĀPP] *and we can only get better and we are keen to carry on with it.*

This teacher now sees RĀPP as a useful response to the wide range of reading abilities within her class. She sees it as a vehicle for reading mileage and for developing students' reading comprehension. She believes that with a teacher aide trained to run the program in a withdrawal situation, together with parents working together to support the program in a planned and cohesive way, the program will provide greater benefits to her students learning to read in Māori.

SCHOOL 2

In this school, assessments were undertaken at the end of Term One to be used for baseline prior to the commencement of the RĀPP program in term two. When the second author returned at the end of term two to gather the second assessment point he found that the RĀPP program had not gone ahead. At this point the principal decided not to gather a second assessment point and that he himself would manage the RĀPP program over the third and fourth terms within a withdrawal school setting only. It is important to note therefore that the baseline data was taken over two terms prior to the second assessment point. In this school the second assessment point was taken at the end of term three. Therefore we need to acknowledge that we have no way of knowing the extent to which any shifts seen in the second assessments were also influenced by class program. Data from School 2 assessments at baseline, then after a first and second term in the RĀPP program, appear in Table 2 below.

Table 2: Shifts In Students' Reading At School 2

School 2			
Students n=18	**Baseline**	**1st RĀPP Program**	**2nd RĀPP Program**
Book Level	**8**	**9.9**	**11.6**
Reading Accuracy	**96.7%**	**98.4%**	**98.6%**
Correct Rate (Words per Minute)	**36.9**	**44.3**	**48.4**
Incorrect Rate (Words per Minute)	**1.7**	**1.2**	**1**
Comprehension	**73.3%**	**82.2%**	**78.9%**

Book Level: Table 2 shows that overall, for the 18 students in School 2, there was an increase of 1.9 book levels in the mean level of book read to accuracy and comprehension criteria between baseline and the first RĀPP program (approximately two terms or 20 weeks) and a further 1.7 book levels between the first RĀPP program and the second RĀPP program (approximately ten weeks).

Reading Accuracy (%): As well as increases at each post program assessment point there were also increases in the reading accuracy scores from 96.7% at baseline to 98.4% after the first RĀPP program, which was maintained on 98.6% after the second RĀPP program.

Correct Rate (correct words per minute): Although reading books at higher levels of difficulty, there were increases in correct reading rate. Between baseline and the first RĀPP program, the correct reading rate improved from 36.9 to 44.3 (over 7 correct words per minute). After the second ten weeks of the RĀPP program, while reading books at 1.7 higher levels of difficulty, the correct reading rate continued to improve from 44.3 words to 48.4 words, (over 4 correct words per minute).

Incorrect Rate (incorrect words per minute): Table 2 shows a further improvement in that there was a decrease in incorrect words read per minute. Between baseline and the first RĀPP program, the incorrect words read per minute decreased from 1.7 to 1.2. After the second ten weeks of the RĀPP program, the number of incorrect words read per minute decreased to 1.0. This was despite students having increased their overall reading level throughout the RĀPP program by 3.6 levels.

Comprehension (%): Table 2 shows that although students were reading books at two higher levels of difficulty, comprehension between baseline and the first RĀPP program increased from 73.3% to 82.2% and decreased slightly after the second ten weeks of the RĀPP program to 78.9% at 1.7 levels higher.

Implementing RĀPP

In School 2, the program was implemented over two terms in a withdrawal school setting only. The principal and teacher from this school talked about aspects of the RĀPP program in their school. The principal suggested that when the program was maintained on a daily basis, within a specific withdrawal space, it was especially beneficial:

> ***Principal:*** *We wanted them to do it regularly on a daily basis, so what we did was, we maintained a program where they came here and that's why the tapes and everything are here. They do their reading and everything on their own with their tapes and we go through the book three times each day and we did that regularly.*
>
> *RĀPP definitely has to be done daily, definitely it is getting the kids into a routine of doing it.*

This principal took responsibility for implementing the program in his school and in so doing found that when it was consistently applied it was especially beneficial and enjoyable for students reading at the lowest levels:

> ***Principal:*** *We found that some kids, especially the low ones did really, really well with the program. They don't like working in groups and things like that so using the RĀPP program we have found some of the kids they excelled in it, they liked it, really enjoyed it. I think it's a positive program, a real good program. It has lifted their reading levels and especially in confidence and fluency.*

A teacher from this school suggested that the repetitive nature of the program helped students with their reading skills and with their ability to understand the text.

> ***Teacher:*** *I can hear it, I can replay it, I can listen to it again. You can't take in everything in one day.*
> *They are learning that practice means repeat, repeat, repeat. So they know if they play it more than once or listen to it or read it or do it more than once, kia mārama (they will understand).*

Students

When asked by the researcher if they had enjoyed participating in RĀPP, all agreed that they had. Then, when asked how they thought listening to the tapes had helped them with their reading, they said:

> ***Tamati:*** *Because you could listen to it and you don't have to read it.*
> ***Hone:*** *Because it was fun doing stuff with it.*
> ***Turei:*** *Because they are cool. Those fellows can do it and then we can copy. So you can know how to read it. It's fun and a bit cool.*
> ***Harre:*** *You get better at reading because they [the tapes] help you read.*

Rangi: *So if you can't read the book you just use the machine.*
Mere: *It helps you read… by telling me the words.*
Shanaia: *Because I like to read… Yeah… By listening to it and then reading with the book.*
Kimi: *It helps me to know my words… because sometimes I don't know my words when I read books.*
Cameron: *They teach you words… to make you brainy.*
Aria: *Because it helps me to learn how to read. Because you are listening to it and it helps you get the words done.*

Although this school did not send the resource home to be used by the students it is clear that students had enjoyed working with the tapes at school and were able to make strong connections to this activity having improved their literacy skills and how this had happened

Overall Effect Sizes for Students Reading at Levels 10 or below
Effect sizes were calculated using the Statistical Package for the Social Sciences (SPSS) on reading levels for students in both schools, whose baseline reading level was 10 or below. These data[1] appear next in Table 3.

Table 3: Overall Effect Sizes for Students Reading at Levels 10 and Below

School One						
Reading Levels	n	M	SD	*t*	*p*	*d*
Assessment at baseline	7	9.14	1.07	14.72	.0	2.75
Assessment after two terms in program	7	11.86	0.90			
School Two						
Reading Levels	n	M	SD	*t*	*p*	*d*
Assessment at baseline	16	7.63	1.63	20.17	.0	2.06
Assessment after two terms in program	16	11.25	1.88			

n is the number of participants in the sample; M or Mean is the average of all items in the sample; SD or Standard Deviation is a measure of how spread out the data are; *t* or the *t* statistic is a measure of how extreme a statistical estimate is; The *p*-value is a measure of how much evidence we have against the null hypotheses; *d* is commonly called the effect size and is the difference between the means. M1 – M2, divided by the pooled standard deviation. The pooled standard deviation is found as the root mean square of the two standard deviations (Cohen, 1988).
Applying the following criteria set by Morgan et al., (2006) it would appear that for students in both schools, whose baseline reading level was 10 or below, shifts in book level from baseline to the end of the second RĀPP program are of statistical significance and that they are also much larger than typical.

Table 4: Criteria For Interpreting Effect Size

General interpretation of the strength of a Relationship	*d*
Much larger than typical	>1.00
Large or larger than typical	0.80
Medium or typical	0.50
Small or smaller than typical	0.20

DISCUSSION

In School 1 RĀPP was more regularly used by the students with their parents at home. In School 2 RĀPP was used in the school alone, as a withdrawal intervention. Both schools managed to complete two terms of approximately ten weeks each, in program. In each school the same researcher was able to conduct assessments prior to the intervention and after two consecutive terms of being in program. In School 1 he was also able to repeat these measures after ten weeks of classroom program alone. Overall, only three students had insufficient data to be included in the final analysis.

Data from students in School 1 show that students who participated in the program began at much higher levels than students in School 2 but showed less overall reading gain. When data from all students from both schools reading at kete kiekie (developing reading skills) were further interrogated, it was found that overall, students working with the program in School 1 (inconsistently within the school setting but more regularly at home) improved by 2.7 book levels over two ten week periods, however during classroom program alone they improved by 0.9 book levels over ten weeks. Students from School 2 (working with the program consistently within a withdrawal school setting) improved by 3.6 book levels over two ten week periods however there are no data for these students to show shifts resulting from classroom program alone. Importantly improvements in book levels for students from both schools did not compromise improvements in reading fluency, reading rates and reading comprehension, which in the main were maintained or improved.

Although both schools were faced with the structural issue of replacing a consistent person to lead the program in the school, both schools were able to overcome this. Staff from both schools believed it was important to have a person run the program in a regular, withdrawal setting. They liked both the taped reading resources, the comprehension activities with which students could self assess independently and then work with an adult, and the monitoring resources. Students and staff shared their own beliefs about how the resource had helped build reading enjoyment and confidence as well as develop reading skills and comprehension.

CONCLUSION

The reading level gains presented as a result of this RĀPP intervention are in line with reading level gains resulting from the use of the TARP resource in English language settings and with the use of Tatari Tautoko Tauawhi, a one-to-one Māori reading tutoring program used in Māori language settings (Berryman & Glynn, 2003; Berryman, Glynn & McDonald, 2004). Importantly, the progress through reading texts of increasing levels of difficulty has not resulted in slowing down students' rates of comprehension as has been noted in these former Tatari Tautoko Tauawhi studies. This was seen to occur when increasing complexity of written Māori language structure and the increasing levels of abstraction and cultural knowledge within text content took students well beyond the level of complexity and abstraction they could cope with in their oral language. The maintained scores on comprehension tasks shown within this RĀPP study might well reflect the personal control students had over their use of the reading materials or it might also include the expert oral language models provided by the readers of the taped stories, as well as the associated comprehension material prepared for each of the taped stories and the availability of Māori language speakers (either at school or at home) with whom they were expected to discuss these stories on a regular basis. These results indicate the worth of oral language tasks in collaboration with competent speakers of Māori such as those providing the oral reading models of texts and then monitoring through appropriate levels of difficulty. Providing readers with many and regular opportunities to 'match' a competent oral / aural reading model with specific visual information in the context of meaningful text, then either in one-to-one or in small group contexts, predicting the likely outcomes of story lines on the basis of prior knowledge and experience, identifying new vocabulary items, language structures and

talking about what this means, as is provided by the RĀPP resource and the method employed for its implementation, appears to have been effort well spent.

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EMBEDDING ICT IN LEARNING: ENGAGING INDIGENOUS STUDENTS … AND THEIR TEACHERS

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Abstract

This paper reports on the Embedding ICT in Learning: Engaging Indigenous Students Project which assisted teachers to improve the engagement of Indigenous students by increasing their awareness of, and responsibility for, their own learning. Information and communication technology and thinking tools were integrated across the students' learning to empower them in the construction of their own knowledge. Teams of teachers from three schools with high indigenous enrolment were supported while experiencing best practice in planning and implementing learning strategies. The schools were encouraged to increase the level of effective use of ICT across the school and the teachers were encouraged to work towards 'transforming' their practice. The strategies for embedding ICT in learning in each of the schools were varied and enthusiastically received by the students. The indicators of student engagement identified by each school indicated attainment of important components of sustainability, i.e., depth, endurance, breadth, justice, resourcefulness and diversity. Project observations and evaluations to be discussed indicate that it was not just the students who became more engaged. Teachers were mentored through a renewal of their professional learning. The observation and reporting of student engagement and its sustainability is to be the focus of this paper.

INTRODUCTION

A call for new approaches to Indigenous education to improve the engagement of Indigenous students was prompted by a continuing lack of national benchmark attainment by these students (MCEETYA, 2006, p. 13). Quality teaching was identified as one of the five domains critical to engaging indigenous students. Within this domain schools need to link teacher development and school development to achieve overall school improvement and need to be able to measure the level of classroom engagement of Indigenous students in the classrooms (MCEETYA, 2006, p. 26). The pedagogy strategy proposed by the Australian Federal Government (MCEETYA, 2005) for all students encourages the use of appropriate ICT-related pedagogies to engage students and support teachers in moving from 'learning-to-use' to 'using-to-learn'. Thus the embedding of ICT in learning is a logical choice to engage indigenous students with the important issues becoming how to do this and how to measure the impact.

Many organizations observe that there is a gap ("knowing-doing" gap) that exists between what people know should be done and what people know about actually doing it. While there might be suitable literature available on innovative strategies to engage students and to embed ICT in learning, teachers still need support in implementing these strategies and measuring the impact. An action-learning environment (McKeown & Obstoj, 2005) introducing an "explore, plan and act" cycle has been shown to be a supportive process for reducing the knowing-doing gap for teachers regarding ICT-related professional learning. This paper reports on the *Embedding ICT in Learning: Engaging Indigenous Students* (EiSEiL) Project, which was designed to help teachers reduce that gap in the area of engaging Indigenous students.

EISEIL PROJECT

Within the bounds of an Australian School Innovation in Science, Technology and Mathematics Project (ASISTM) grant, three schools combined with the University of New England in the EiSEiL Project. These schools sought to improve the engagement of Indigenous students by embedding ICT in their learning to increase their awareness of, and responsibility for, their own learning. Relevant background and experience for planning the project activities at the classroom, professional learning and school planning levels was provided to the project team by other projects such as reported in the Journal of Computer Assisted Learning Volume 20 Number 6 (JCAL, 2004), as well as from professional practice at local and interstate Australian schools. The six principles of pedagogy strategy articulated by MCEETYA (2005, pp. 6-7): learner focus, educational soundness, professional learning, diversity, alignment and collaboration, provided an Australian perspective for guiding the planning of this innovative ICT-related pedagogy.

This paper reports on the learning experiences designed with embedded ICT in the project schools, the indicators of engagement identified by the teachers, the sustainability of the increased engagement and an unexpected bonus, the resulting teacher engagement. But first, some project background is provided.

The project aimed to increase student engagement by integrating ICT across student learning experiences to empower the students in the construction of their own knowledge. To achieve this teams of teachers were supported in the following ways: they were provided with opportunities to experience best practice; they were assisted in planning, implementing and reporting on in-school learning experiences; and they were mentored in observing and reporting on their observations of student engagement. Project activities were designed to encourage the teachers to become reflective practitioners and to form a community of practice. Essential to the sustainability of any change developed from the project was the fostering of an increased level of effective use of ICT for learning at the whole school level and not just at the individual teacher level. The observation and reporting of student engagement and its sustainability is the focus of this paper. Following are project's operational definitions of engagement and sustainability.

Engagement

The Australian Department of Education, Employment and Workplace Relations (DEEWR) *Schooling Issues Digest* (Russell, Ainley & Frydenberg, n.d.) provides a good working definition of engagement as "energy in action", focusing on the connection between the learner and the activity. Broadly speaking this involves the connection between the learner and the school environment but more specifically refers to the attitudes, interest and self-efficacy of students in particular learning situations. A better teacher understanding of student engagement is essential for effective learning experience design and to foster teacher desire to measure and report on engagement. An extensive review of published literature by Fredricks, Blumfeld and Paris (2004) provides a better understanding of the complexity of engagement by describing three distinct types of engagement: behavioural, cognitive and emotional.

Behavioural (**B**) engagement involves: (i) positive conduct, e.g., adhering to classroom norms, absence of non-disruptive behaviours; (ii) involvement in learning tasks, e.g., effort, persistence; and (iii) participation in school-related activities, e.g., athletics, governance. These behaviours may be academic or non-academic.
Emotional (**E**) engagement involves: (i) affective reactions in the classroom, e.g., interest, happiness; (ii) affective reactions to the teacher, e.g., liking, respecting; and (iii) identification with school, e.g., belonging, valuing. These overlap with constructs used in research on motivation.

Cognitive (**C**) engagement involves: (i) psychological investment in learning, e.g., desire to go beyond the requirements, preference for challenge; (ii) inner psychological investment, e.g., desire to learn, desire to master skills; and (iii) self-regulation, e.g., use of metacognitive strategies, evaluating cognition when accomplishing tasks.

Although presented as distinct, the three types of engagement (**B**, **E** and **C**) are "dynamically interrelated within the individual" (Fredricks, Blumfeld & Paris, 2004, p. 61). Cleary, this can confuse the issue when indicators of each type of engagement are being observed or developed.

Sustainability

The researchers and teachers were aware that the improvement to engagement for Indigenous students needed to be sustainable and deferred to the *Quality Teachers: Quality Teaching Forum Report* (ACSA, 2005) for guidance. At this forum Professor Andy Hargreaves (Chair in Education, Lynch School of Education, Boston College) stated that, from a necessary broader view, sustainability "does not simply mean whether something can last. It addresses how particular initiatives can be developed without compromising the development of others in the surrounding environment now and in the future" (ACSA, 2005, p. 35). The sustainability of student engagement with learning has seven important characteristics that teachers should strive to achieve:

1. *Depth* (it matters) – there is a need to focus on what matters in education, i.e., learning;
2. *Endurance* (it lasts) – there is a need for leadership to be spread over time as what lasts is not a particular program but the principles and the people behind that program;
3. *Breadth* (it spreads) – there is a need to develop a learning community for the students and the teachers;
4. *Justice* (it does no harm to the surrounding environment) – there is a need to work with the community to bring them closer to the school;
5. *Resourcefulness* (it conserves expenditures and does not burn people out) – there is a need for renewal at the physical, emotional, intellectual and spiritual level;
6. *Diversity* (it promotes diversity and cohesion and avoids standardization) – there is a need to provide the scope to focus on ICTs relevant to needs; and
7. *Conservation* (it honours the past in creating the future) – there is a need to focus evaluation on what is 'important to pass on' and 'what should be put aside'.

Context

The project involved ten teachers from three schools in regional New South Wales near the University of New England. One school (government) had a K-2 only student cohort (27% Indigenous) and three teachers were involved in the project. The other two schools (one government and one independent) were K-6 (60% and 94% Indigenous respectively) and three and four teachers respectively were involved. Many Indigenous students at the schools were not engaged with their learning and teachers were seeking ways to use ICT to improve this situation. The schools were encouraged to work towards 'transforming' their practice.

The project aimed to include all teachers in the schools to foster sustainability of the anticipated changes. The teams of teachers from each school, experienced best practice, planned and implemented in-school strategies, and reported on the process. The teachers were mentored by educators with relevant experience, including a teacher who had already implemented engaging learning experiences with Indigenous students, and were encouraged to observe and report on their observations of student engagement. There were six key activities that were designed to develop a collegial relationship between the teachers as they embarked on a process of change in their schools.

Activity 1. Apollo Parkways Primary School Practicum (July, 2006)
All teachers attended a three-day Practicum Experience at Apollo Parkways Primary School (a Victorian school recognised for excellence) that motivated them for action by providing them with new ideas and resources to challenge their ways of thinking about learning and to facilitate change. Teachers came to realise the power of whole-school change underpinned by a commitment to the integration of ICT into teaching and learning activities, and were supported, as school teams, to develop an action plan (directions map) to be used to inform the development of their school initiative plans.

Activity 2. Initial Professional Sharing Day (August 2007)
This day was held at the university to allow each school to meet the three teacher associates, who were experts in working with Indigenous students, ICT in learning, and Learning to Learn strategies, and to produce a learning experience plan for implementation in their school.

Activity 3. Implementation of In-school Initiatives, including School Visits (September to December 2006)
Schools implemented the learning experience initiatives they had planned and were supported by visits from the teacher associates who provided expert advice on teacher practice in embedding ICT. These visits helped with the difficult task of incorporating ICT-related learning activities into across-school teaching programs to improve engagement.

Activity 4. Planning Day (February 2007)
This day was organized to allow teachers to explain how they had been resolving implementation issues in their schools, to refine individual and whole-school teaching programs for 2008 and to share relevant indicators of engagement that they had identified in their classrooms. The indicators of engagement are shared later in this paper.

Activity 5. Final Professional Sharing Day (April 2007)
This day was held at the university and allowed the teachers to share the success of their initiatives and to refine their whole-school plans for ICT in learning across the curriculum. Indicators of engagement, previously identified by the teachers, were recorded on cardboard signs and displayed on the walls to provide visual stimulus.

Activity 6. DVD produced about engaging learners (October 2007)
This resource was developed to share with other schools and teachers. The content was provided by teachers through the various project activities and through interviews conducted with teachers and students involved.

ICT-RELATED STUDENT LEARNING EXPERIENCES

Each school was encouraged to develop learning experiences that suited student needs, which often involved improving teacher expertise. Although the focus was Indigenous students, all learning experiences were implemented in classrooms where non-Indigenous students were also involved. The strategies for embedding ICT in learning varied between schools and those ICT-related learning experiences that were rated as more successful in engaging the students are reported below. The teachers also shared tips to facilitate learning with Indigenous students.

The government K-2 school engaged students in entering weather readings via the Globe Project website; placing text and photos into a Powerpoint presentation about people who worked in their school; and using Learning to Learn tools to support their work with computers. Critical changes were made to the classroom layout to maximize access to the computers. Two particularly inspiring activities with these young students involved a ‘virtual’ visit to Western Plains Zoo including using Google Earth to locate the zoo, and a model writing activity stimulated by email correspondence about a ‘goat in the boat’.

The independent K-6 school engaged students in using Inspiration software to create concept maps, but was initially severely restricted in terms of what they could achieve due to lack of computing resources. They relied heavily on visits to the other K-6 project school where students acted as peer tutors in web authoring activities. Later new computers arrived which allowed teachers to implement other activities including animation.

The government K-6 school engaged students in creating animations that were shared with parents via mobile phones. The students also developed *Powerpoint* storybooks; used sound mixing software to create sound tracks for other projects such as animations; developed movies; and built portfolios of work using *iWeb*. The students were very supportive of students from the independent K-6 school when they visited and helped them to become more familiar with a range of software including *iWeb* and *Garageband*.

An important part of the teacher professional learning was the sharing of teaching tips that facilitated the day-to-day implementation of the various learning experiences. While this may read like a 'to-do' list in any teacher education program, these tips are important because they were compiled by teachers and were found to particularly facilitate the engagement of Indigenous students.

Tip 1. When students are given more choice and allowed more control of components within a learning experience, they are more independent in their approach to learning.
Tip 2. When students are provided with collaborative activities, they have 'permission' to work together and use cooperative group strategies.
Tip 3. When students are allowed to contribute to the creation of assessment criteria, they feel ownership and have a better understanding of the criteria.
Tip 4. When students utilise higher-order thinking processes, they are able to learn about their own learning.
Tip 5. When students are allowed to 'teach' the teacher(s), they experience a breakdown of barriers.
Tip 6. When students are allowed to display a mapping of activities visually, they understand the relevance of their work and are encouraged to complete work.
Tip 7. When students are no longer immersed in a reward/punishment culture, they develop an appreciation of importance of ICT in the learning process.

INDICATORS OF ENGAGEMENT

During the planning day each school team of teachers identified indicators of engagement that they had observed in their schools during the implementation of the ICT-related learning experiences. The schools then shared their indicators, which were collated and refined into one set of indicators. Altogether 28 indicators were described, of which 14 (50%) were behavioural, 4 (14%) were emotional and 10 (36%) were cognitive. It was not unexpected that so many of the indicators were behavioural, as teachers tend to think of engagement in behavioural terms. In fact, behavioural indicators are the most readily and reliably observable indicators.

SUSTAINABLE ENGAGEMENT

As part of the Planning Day, the set of indicators of engagement were then viewed through a sustainability lens to gain a sense of whether the engagement observed might in fact be sustainable. Each indicator was categorized by the participants into one of the seven characteristics of sustainability, i.e., depth, endurance, breadth, justice, resourcefulness, diversity and conservation. This mapping (Table 1) showed that the identified indicators of student engagement covered the first six of these characteristics. The capital letter after each indicator shows the type of engagement, (B)ehavioural, (E)motional or (C)ognitive.

Table 1. Indicators Of Student Engagement

Depth	
Students …	
• took risks with more confidence	B
• peer-tutored with enthusiasm	B
• interacted more with other students	B
• learnt because they wanted things to happen	E
• enthused with expectation of computer use	E
• took responsibility for content	C
• learnt new ICT applications	C
• liked the opportunity to create something meaningful	C
Endurance	
Students …	
• extended independent behaviour from ICT to non-ICT activities	B
• extended peer tutoring friendships into the playground	B
• behaved more acceptably with the nastiness of 'you're dumb' changing to 'let me help you'	B
• overcame their 'shame' feeling and were more confident when presenting	E
• worked independently within groups	C
• wanted to learn new skills	C
• took on specific roles in learning situations	C
Breadth	
Students …	
• wanted to use ICT in their free time	B
• taught teachers how to use equipment	C
Justice	
Students …	
• queried when a 'turn' is missed	B
• attended school more consistently	B
• brought parents into school to view work	B
• were very proud when showing work to parents who contributed	E
• brought photos from home to scan	C
Resourcefulness	
Students …	
• took risks rather than asking for help	B
• worked in groups then looked for other opportunities to work together	B
• initiated work without teacher direction	B
• took more responsibility for own learning	C
Diversity	
Students …	
• wanted to use the equipment even when very young	B
• saw ICT as part of learning	C

No engagement indicators were mapped into the seventh dimension, *Conservation* but teachers believed that it was important to focus on 'what is important to pass on' and 'what should be put aside'. The large number of indicators characterised as *Depth* or *Endurance* reflects the conservative view that teachers have of sustainability. The coverage of most characteristics of sustainability in this mapping indicates a sense that the engagement of Indigenous students will be sustained beyond the life of the project. However, the teachers in these schools need to pay more attention to possible indicators of engagement related to those characteristics of sustainability that are less commonly addressed; breadth, justice, resourcefulness and diversity to improve the sustainability.

TEACHER ENGAGEMENT

Observations made by the researchers and evaluations completed by teachers indicated that it was not just the students who became more engaged during the project. An important component of the EiSEiL project design was the mentoring provided for the teachers involved and their renewal in terms of professional learning. This, together with the increased student engagement, created unexpectedly high levels of engagement in the teachers. Some indicators of this engagement were that the teachers.

- were enthusiastic to get started with in-school implementation after the inspiring visit to Apollo Parkways Primary School;
- developed strong teacher-to-teacher relationships which underpinned effective peer tutoring and mentoring;
- offered to assist teachers in other schools;
- took time to learn new skills;
- worked 'with' the students;
- attended extra courses voluntarily;
- reflected insightfully on their progress;
- presented to a wider audience; and
- wanted to continue with more activities after the completion of the project.

Five recommendations come from these teachers' experiences working with Indigenous students and ICT. First, the importance and power of a whole-school plan becomes even more obvious after visiting a best practice school. Second, handing over more responsibility to students is better received than 'hand-feeding' the students and paves the way for ICT to appear across the curriculum. Third, positive comments are likely to come back to the school from families when ICT-related products are shared with families. Fourth, success is more likely when a project based around new ICT-related learning activities is broken into 'do-able' chunks and sufficient time is allowed for new learning. Finally, supportive activities and mentoring during the project allows teachers to come out a project having lost any initial feelings of 'not knowing what I am doing'. These recommendations should be taken into consideration whenever teachers are planning to undertake any ICT-related project.

CONCLUSION

The opportunities that the EiSEiL project provided proved engaging for both the students and the teachers. Insight was gained into which learning activities with embedded ICT were more interesting for Indigenous students. Although, it is possible that the findings of this project would also be applicable to the learning of non-Indigenous students, the design of the research did not allow this issue to be addressed. As the students showed increased engagement with the activities implemented by the teachers, ICT in learning was instilled as an integral part of the teachers' planning. This change happened at the school-level, as well as at the classroom-level, because the project involved a group of teachers from each school not just one teacher. Further commitment has been made by the schools involved to 'engage' in more projects designed to embed ICT to support student learning. More detail about the project is available in the EiSEiL Project Report (Reading, 2007a) and the EiSEiL DVD (Reading, 2007b).

While the indicators identified provide some insight into the engagement of Indigenous students in ICT-related learning experiences, it must be remembered that these indicators are from a group of only ten teachers from three schools in one regional area. They should not be considered as indicative of expectations for Indigenous students in all schools but instead provide a starting point for those teachers who want to describe the engagement of their students. Research is now needed to support teachers in proposing indicators of engagement prior to implementing ICT-related learning experiences; collecting the relevant data for each measure; and preparing a formal measure of the change in engagement level of Indigenous students as a consequence of the embedding of ICT in their learning.

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CRACKING OPEN TEXTBOOKS IN THE MIDDLE YEARS

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Abstract

In South Australia, inclusive learning environments accommodate the needs of students who learn differently. However, the use of textbooks in the middle years prevails while student ability to access these texts is often compromised through a combination of factors. In this paper the word TEXTS (Texts, Environment, conteXt, Teacher, Student) provides an acronym to frame the discussion around how learning outcomes can be enhanced for all students, including those with learning difficulties. A specific focus on inclusive practices, explicit teaching, feedback and reflection inform the ideas outlined. The use of textbooks in the middle years, is one source of information that must be effectively managed and supported to enhance the achievement of all students.

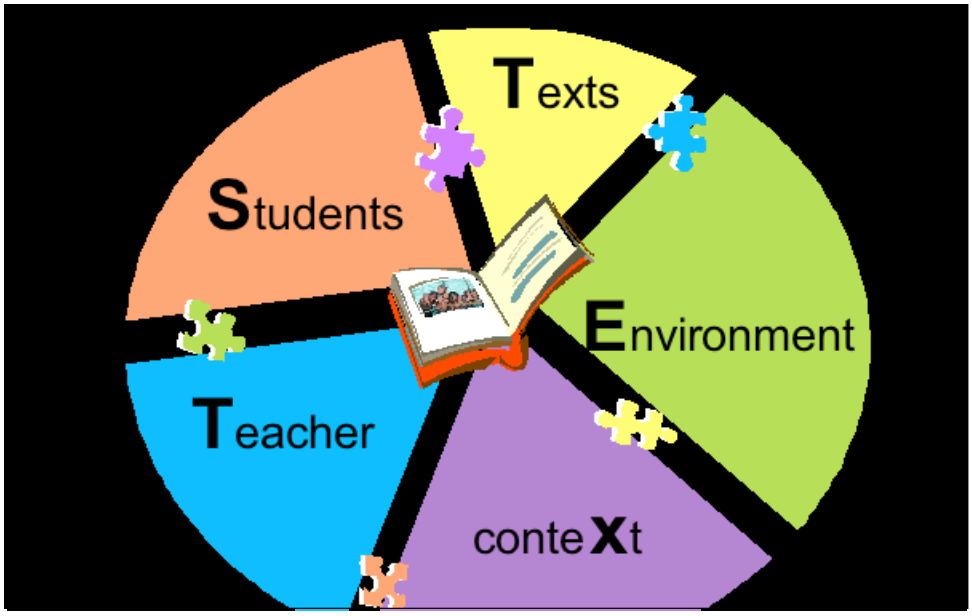

Figure 1. Texts, Environment, ConteXt, Teacher, Students

INTRODUCTION

Students in the Middle years of school (Years 5-9) can be confronted by multiple textbooks in a range of curriculum areas. For some students the readability level of the text is far above their independent reading age, and in essence, the texts are inaccessible.

This paper explores how the gap can be narrowed in order to address educational disadvantage and facilitate the successful achievement of all students within the context of an inclusive learning environment. The acronym TEXTS (Texts, Environment, conteXt, Teacher, Students) frames the discussion centred on student engagement levels and improving learning outcomes with each component of this acronym addressed in turn in the following discussion.

T: How are Textbooks problematic in their use in Middle schools?
E: How do textbooks shape and transform the Middle school Environment?
X: How can the use of textbooks reflect and respond to curriculum conteXts?
T: How do Teacher practices support the effective use of textbooks?
S: How can Students develop skills that will enable them to access textbooks?

T: HOW ARE TEXTBOOKS PROBLEMATIC IN THEIR USE IN MIDDLE SCHOOLS?

Middle school students face increased amounts of reading and the expectation they can comprehend the content in texts. In some learning environments there is a reliance on textbooks to provide content information and learning tasks. This is confronting for students reading below the text level. Students may experience frustration and failure when unable to read course material. As Pumfrey (1991) observes:

> The more the readability level of a text exceeds the reading level of the pupil, the greater the probability that the pupil will experience difficulties. The wider the gap, the more likely it is that the text will be at the frustration level. Such pupil-text interactions are particularly damaging to the motivation of pupils who experience difficulties in learning. (p. 189)

A focus on textbook-generated, content delivery will disadvantage students who learn differently and will require more than the usual teacher focus on the teaching and assessment of subject specific curriculum. The challenge exists for teachers to work to narrow the disparity between textbook readability level and the achievement of students who may read two to three years or more below this level.

The implications of using text books at a reading level beyond the ability of a student is to reinforce the cycle of failure, to alienate and marginalise students who learn differently, to reduce the sense of excitement and fun surrounding the learning process and to limit access to information and understanding about topics. Such marginalisation and failure can result in an increased incidence of inappropriate student behaviours such as aggression, task avoidance and disruptive behaviours. A reliance on text books also reduces teacher effectiveness and enjoyment as topics are covered systematically rather than generated from class interest and possible outcomes are limited by the lists of questions in the text that test rather than challenge thinking. Textbook reliance has not kept pace with the inclusion of students with diverse learning needs into regular classrooms (Fiore & Cook, as cited in Foremen, 1996, p. 158).

Armbruster and Anderson (1996) report textbooks can lack ‘considerateness’, containing densely worded paragraphs, significant amounts of new vocabulary and the introduction of numerous concepts with insufficient explanation. Science and Social Science texts often pursue enormous amounts of content and little in-depth coverage. Textbook readability levels can be higher than assigned grade level, making it difficult for students when text adaptations do not occur (Mastropieri, Scruggs & Graetz, 2003). Text readability level can be a major factor influencing whether students read and understand material (Vaughn, Bos, &Schumm, 2003). Difficult texts in terms of concepts, vocabulary and sentence complexity may not be easy to process, and can lead to a high error rate. If teachers are under pressure to cover certain amounts of text within a period of time, they may move steadily through the material even though some students have not understood it.

‘Considerate’ text on the other hand, enables information to be extracted easily and provides support when the reader does not understand (Armbruster & Anderson, 1988). Texts considered friendly to the reader are determined by features such as headings, vocabulary boldface, chapter summaries, connectedness of ideas, conceptual density, and amount of new vocabulary introduced and provision of instructional devices such as marginal annotations (Vaughn, Bos & Schumm, 2003). Skilled teachers can recognize text features that support student learning as well as when they need to supplement it. The ultimate judge of the readability and friendliness of a textbook is the reader. Students with reading difficulties need to learn how to talk about the textbook, problems they have with it and effective strategies to use to work with these difficulties.

E: HOW DO TEXTBOOKS SHAPE AND TRANSFORM THE LEARNING ENVIRONMENT?
The routine use of textbooks in Middle school classrooms can dictate the curriculum rather than provide a resource to support learning. When textbooks are relied upon for the content mapping of a course, the learning experiences being offered to students are at risk of being shaped by the text. This usually informs task requirements and may reflect a traditional reading component followed by individual question and answer responses. Does the use of textbooks reflect a just and contemporary learning environment?

The Salamanca Statement (1994) continues to set global directions around inclusion. Shaddock (2007) describes inclusion as the fundamental shift from the normative framework that assumes that the majority of students are "normal" whereas the needs of the minority are "extraordinary," "exceptional," or "special." Shaddock suggests that inclusion is an "approach to school education that reflects contemporary views of heterogeneity, difference and individual needs rather than homogeneity, deficit and group-oriented programs." (p.25). Booth, Ainscow, Black-Hawkins, Vaughan & Shaw (2000) outline how educational environments can address inclusion through the proposal of a systematic overhaul of school cultures, policies and practices.

For example, McDonnell (1998) identified foundational strategies that are consistent with educational and social goals for inclusion. These include the need for instruction to target concepts to ensure active engagement and the requirement that instruction be geared to students' success. New information needs to be linked to previously learned skills. Grouping strategies like cooperative learning, peer tutoring and heterogeneous grouping arrangements can all contribute to the creation of optimal learning environments. Key considerations also include the systematic introduction of new concepts and the provision of immediate feedback. Hattie (2007) is a strong proponent of the need for immediate and explicit feedback.

Mirroring McDonnell's work, optimum learning environments, underpinned by an understanding of inclusion, have been described in the Department of Education, Queensland document Productive Pedagogies, (Lingard et al., as cited in Foreman,2005, p. 105), as promoting an intellectual quality to school work; connecting students to their learning and recognising difference as a positive feature of supportive classroom environments. When learning is related to real life experience, students are able to feel more connected to the process. An element of student voice supports students to set goals and manage their own learning as they are involved in the decision making process. This is an empowering experience in any context.

Textbooks within learning environments where productive pedagogies are evident can be used as an effective resource. They provide one source of information for students to use to inform their understandings. When textbooks shape the learning environment, however, the inclusive culture of that context can be challenged. It is the learning environment that ideally transforms textbook use as a way of enhancing learning experiences. The challenge is for teachers to use textbooks as a tool to enable all students to access the content.

X: HOW CAN THE USE OF TEXTBOOKS REFLECT AND RESPOND TO CURRICULUM CONTEXTS?
Whole class use of textbooks as the basis for content delivery, is not reflective of inclusive, universally designed curriculum. Orkwis and McLane (as cited in Wehmeyer, et al., 2001, p.140) describe universal design as, "the design of instructional materials and activities that allows the learning goals to be achievable by individuals with wide differences in their abilities." Is it equitable to ask all students within the class to complete the same amount of work within the same amount of time? It is clear that many students require adjustments and accommodations to meet their learning needs. Texts are a static structure in themselves so by their very nature, they do not provide a flexible basis for constructing curriculum. The

challenge for teachers is to interpret and create curriculum which allows for transformative learning opportunities for all.

A constructivist view of learning which underpins the South Australian Curriculum Standards Accountability Framework (SACSA) is based on an understanding that knowledge and beliefs are formed within the learner and that learning is a social activity that is enhanced by shared inquiry. Learners play a critical role in assessing their own learning. Within a constructivist approach, catering for all students involves structuring the unit of work so as to build on prior knowledge and experience providing students with opportunities to work in their areas of strength to build skill development while learning about the topic. Goals for the student require prioritising, and assessment structured in order to allow the student to demonstrate learning in other ways. There may be a need to allow for additional time to complete modified tasks, oral instructions may need to be accompanied by modelling and visual supports and opportunities for additional practise considered. Some students learn best when working in groups and others prefer to complete tasks independently.

A differentiated approach to curriculum delivery will enhance inclusion as such methodology acknowledges that students learn differently and that different learning opportunities need to be considered at the planning and implementation stages of programming. This is consistent with the principles of universal design. Carol Ann Tomlinson (2001) identifies three possible ways of differentiating the curriculum. (1) content including multiple options for taking in information; (2) process including multiple options for making sense of the ideas; and (3) product for example, multiple options for expressing what they know. For highly able students, consideration of depth, complexity and pacing of instruction and tasks will need to be factored into the program design. For students who are two or more years behind their peers in reading it will be necessary to provide alternative ways for students to access the information they need and demonstrate their learning. Gardner's Multiple Intelligences, Bloom's Taxonomy and DeBono's Six Thinking Hats are useful tools to use when planning for instruction in an inclusive learning environment.

Ideally, the use of textbooks reflects and responds to curriculum frameworks. By varying performance goals and adjusting expectations to ensure success, students can access texts to inform understanding thereby fulfilling requirements for learning. For effective learning it is important for teachers to consider the way in which text books are utilised and the skills students need to develop to access the information in texts.

T: HOW DO TEACHER PRACTICES SUPPORT THE EFFECTIVE USE OF TEXTBOOKS?

Teacher values and beliefs impact on student learning outcomes. As Westwood (2005) comments, "Teachers' classroom practices are strongly influenced by the beliefs they hold about learning and teaching." (p. 81). It would therefore seem productive to invest in professional development for teachers, that challenges teachers to reflect upon their attitudes to teaching and learning and consider their beliefs and philosophies. It is when there is a shift in teacher belief that a shift in practice will occur. A teacher whose philosophy reflects a commitment to inclusion is more likely to be flexible enough to provide opportunities for success in a rewarding learning environment for those students who learn differently.

Productive Pedagogies, as a balanced theoretical framework, enables teachers to reflect critically on their work. It encourages teachers to consider whether they are using an intellectually challenging and relevant curriculum in a supportive environment and making intelligent decisions about individual student needs (Productive Pedagogies, 2002).

Shaddock (2007) described reflective practice as a significant component of teacher effectiveness. In addition, Gibbons (2006) operationalised reflection as giving attention to past thinking, as well as reflecting and evaluating the content of that thinking. Hattie (2007) makes the reflective task even more explicit by advocating a process of thinking, procedure and content review informed by feedback, in order to actively reflect on learning.

In terms of teacher practices that support the effective use of textbooks, teachers could cater for the literacy of all students by accepting that it is the responsibility of all teachers to support literacy development. The use of explicit instruction, thinking aloud and a differentiated approach to instruction is supportive for all students with reading difficulties. The development of cloze activities designed to facilitate information processing for instance, will enhance student access to information. Planning literacy tasks that develop understanding rather than test facts, activities designed to facilitate information processing, scheduling specific times to allow students to engage in reading also develop reading behaviours. In general, teachers who reflect on their practices are most likely to be effective in working with their students.

In relation to teachers working with students whose reading levels are significantly below that of the textbook level, teachers may consider a range of specific strategies. These may include working individually with students to master meaning and vocabulary, and rewriting parts of the text that is of a high level of reading difficulty. Rewriting text at a commensurate level to the students' abilities assists them to gain confidence and to understand the content despite reading difficulties. Rewriting text may involve adaptations to the level of sentence complexity and substitution of alternate vocabulary (Salend, 1990). Whilst teachers may feel adapting textbooks is time consuming, adaptations are useful to students at all achievement levels and can be worth the planning time (Vaughn, Bos & Schumm, 2003).

Teachers are encouraged to focus on the use and teaching of strategies that will assist student learning and understanding of content material. It is important that teachers remain aware of the nature of the difficulties and frustration that can be experienced by some students as they approach reading materials. Teachers need to accurately assess and use this information to complement student's abilities so they achieve a sense of success. Assignments and tests that are based on textbook materials need to be matched in terms of content and length to student's skill levels. Ensuring a positive teacher-student rapport and providing students with descriptive praise related to task performance helps students connect effort and outcome.

Availability of additional support staff to work individually or with small groups of students may be helpful. Giangreco (et al, 2005) cautions that having a paraprofessional working closely with a student can have inadvertent detrimental effects including social isolation for the student, the creation of a dependency model and interference with teacher/student relationships. As teachers are the most qualified person in the situation, it would make sense that the teacher supported the student. However this is not always possible in classroom situations. Changes in pedagogy and practices may be delayed when immediate support for the student is provided and whole system changes that would support the inclusion of students who learn differently, can also be deferred. Therefore although the use of paraprofessionals can be effective, this strategy needs to be considered with care.

S: HOW CAN STUDENTS DEVELOP SKILLS THAT WILL ENABLE THEM TO ACCESS TEXTBOOKS?

When specific reading strategies are explicitly taught, opportunity provided for practise, reflection and feedback, students can develop skills that will enable them to successfully access textbooks.

Prior Knowledge
Students bring a range of knowledge and experience on topics covered in textbooks that teachers can capitalize on before introducing textbook chapters. Sousa (2005) found that activating student's prior knowledge can significantly influence their comprehension of new concepts and the vocabulary found in the text. Reading difficult content area text is made easier when students can relate the text to what they know. Questions can be used to engage students in dialogue about what they are about to read and its connection to their background knowledge. A science text book, as an example, may cover the topic of weathering and erosion. Teachers can ask students to share what they know and can stimulate interest in the topic by showing photographs of well known landmarks that illustrate examples of weathering.

Purpose Setting Activities
Purpose setting activities build on student prior knowledge and provide students with a reason for reading the text and engaging in associated learning tasks. These activites can guide the reading process, especially for struggling readers. The KWL (Know; Want to know; Learned) strategy is an example that different subject teachers can use (Ogle, as cited in Konza, 2003, p. 99). Using this strategy prior to text reading, students brainstorm and record all they know about the topic e.g. weathering. They then generate questions or issues they want to know, and after reading the text, record a summary of the main things learned. Generating questions and making text predictions prepares students to read and understand the text with a clear purpose and a plan of action in mind.

Text Vocabulary
Text vocabulary may be specialized and intimidating if presented at a pace whereby students have little time to comprehend and remember word meanings. Teaching certain vocabulary separately, prior to text reading, may be an important instructional decision. Misunderstanding text vocabulary central to the topic could present difficulty with comprehension. Students may in fact be learning both a new word and a new concept. To continue with the example of weathering, words such as erosion and chemical weathering may be unfamiliar and particularly challenging when major concepts are linked to other new concepts e.g. compaction to sediment. These words can be identified in advance of assigning reading and students encouraged to write a definition, even if it is a guess. Following text reading and discussion, definitions can be adjusted if needed.

Graphic Organisers
Graphic organizers may be used at any stage of the reading process, as either advance organizers or for summarizing relationships among key points during or after reading texts. Graphic organisers can be used before reading to help students identify important concepts and how they relate to each other. Understanding relationships in advance, assists in text comprehension and makes it clear to students with reading problems what to focus on (Chmielewski & Dansereau, as cited in Sousa, 2005, p. 192).

Organisational Patterns
Texts based on content from different disciplines may organize information differently. Assisting students' understanding of these organizational patterns may facilitate their learning. For example Social Studies texts may use a cause and effect organization to present key information. Teachers can point out these patterns so students can organize their thought processes when reading the material.

Read Aloud
During text reading, teachers may read aloud to the class, parts of the text that describe complex concepts. Understanding may be enhanced as students hear the text even though they may have trouble reading it themselves. Recording certain text selections on audio is another method that enables access for students experiencing reading difficulties. Questions

by the teacher to students about the text will also assist them clarify what they are reading and help them interact and review what has been read. Too often weaker readers will struggle with individual words in the text rather than construct meaning. Teacher questions support and advance how much students learn from reading and encourage them to think more analytically about the subject matter they are reading (Konza 2003).

Post Reading

After students finish reading, they can be taught to clarify understandings, verify predictions, connect new knowledge to prior knowledge and organize information. They may generate questions at different levels of complexity from the text content which can be given to their peers to answer. As students formulate questions it assists their awareness of whether they understood what they have read. Prediction of vocabulary word meanings which may have occurred in the pre-reading phase can be revisited at this point and verified in the light of new understandings. Following the example of weathering and erosion, students could keep learning logs, write notes and formulate questions. As they read and write students have the opportunity to reflect, evaluate ideas and compare and contrast information based on their prior knowledge. Teachers can also monitor student learning throughout these activities. In the post reading stage students can be encouraged to move beyond reading the text to the application of what has been learnt. Cooperative groups of students can, for example, discuss and record their solutions to the problems that human activities are causing in terms of the weathering of the Egyptian pyramids. Text understandings are consolidated when they are applied to a new situation**.**

Study Guides

Study guides are particularly useful when the text is dense and contains complex vocabulary. The best guides are versatile, easily constructed and consist of questions or statements emphasizing important content information. They are designed to accompany reading rather than follow it and provide structure for reflecting about what has been read (Wood, Lapp & Flood, 2001). A study guide can include activities that match key words to their correct definition, as well as cloze exercises where key words are deleted from summary passages. This is another way of monitoring students' understanding of what they read.

Comprehension

Reading comprehension skills develop as students are taught to use effective text processing strategies (Pressley, as cited in Westwood, 2003, p. 113). Presenting reading material that is interesting and of an appropriate readability level facilitates skill development. Comprehension strategy training needs to be applied to real texts increasing the likelihood students will transfer these taught strategies to their independent reading. Teachers should aim to teach comprehension skills and strategies, rather than simply test comprehension. Examples of strategies that can be used include highlighting key points in texts, identifying where and what the difficulty is in a text and looking ahead for information in the text that might help resolve the difficulty. Understanding of text is supported by adjusting reading speed to match text difficulty, slowing down for the more challenging sections and being taught skimming and scanning skills. Previewing reading comprehension questions before the passage also helps students know what to look for in terms of key information prior to entering the text. Teachers can demonstrate different strategies, including how and when they are carried out, and why they should be used. In doing so, teachers model the processes they use by 'thinking aloud' to students as they read.

PQRS

Research indicates the PQRS reading comprehension strategy has produced some impressive results. Each letter in the mnemonic signifies a strategy step (Swanson, as cited in Westwood, 2003, p. 113). It involves the steps of preview (scan the text, attend to headings and what is already known about the subject); question (generate questions such

as 'What do I expect to find out from reading this?"); read (the text is read and reread if needed, clarifying questions are answered) and summarize (main ideas are identified and stated in student's own words). The teacher initially models the application of the PQRS approach. Subsequently, students appreciate the importance of having a plan of action for gaining text meaning and the value of self questioning and self monitoring while reading. Students experiencing difficulties with reading comprehension benefit from practicing this strategy with the teacher and receiving feedback about their efforts. Over time students assume more responsibility for performing the strategy and evaluating their own performance.

Paraphrasing

Effective paraphrasing can help students learn from a range of different texts. Paraphrasing incorporates reading, writing, listening and speaking which enables increased understanding of the material and greater memory of the text (Fisk and Hurst, as cited in Sousa, 2003, p. 67). Students hear the text read aloud, then read it to themselves, taking notes, identifying possible definitions of unfamiliar words and main ideas, and record these in their own words. Paraphrased texts are discussed with peers, comparing the similarities and differences between them. Teachers should devote time to teaching how a text sample can be best summarized and paraphrased. If difficulties exist, students can be given partially completed summaries to finish. Note taking and summarizing information should be modelled by teachers with students through guided and independent practice. Students can work in small groups reading sections of the text to develop these skills. Investigating and interpreting material in increasing depth develops information processing skills. The reciprocal teaching process developed by Palincsar and Brown (as cited in Konza,2003, p. 101) is an example of an approach where teachers and students become partners in locating main ideas, clarifying sections they are unsure of, summarizing and predicting information. During the process of reciprocal teaching, the teacher gradually hands over responsibility to students as they assume leadership in discussions and eventually master these strategies for independent use across a variety of contexts.

Metacognition

The PQRS strategy is an example of improving skills through a task approach coupled with metacognitive strategy training. Metacognitive instruction focuses on tactics that require students to monitor the appropriateness of their responses and decide whether a particular strategy needs to be applied in a given situation and is successful. Metacognition involves inner verbal self-instruction – talking to one's self in order to reflect and review. This is important for students with learning difficulties who may be passive learners, with little confidence in their ability to control learning events. Self regulation requires that students play an active role in monitoring the effects of various actions and decisions made while engaging in learning tasks. For example, as tasks are completed, students can learn to appraise the results of their efforts, verbalising their conclusions aloud; e.g. "I did that well because..." Verbalising such attribution statements may change students' perceptions about the cause of their success or failure in school work. Grainger and Frazer (as cited in Westwood, 2003, p. 60) discuss the negative attributional styles of students with reading disabilities. They recommend teaching students to use positive self talk to overcome personal reluctance and to counteract negative beliefs linked to their reading difficulty. Attribution retraining has maximum value when combined with the direct teaching of task approach strategies that accompany particular curriculum areas.

Selection of Materials

Reliance on a single textbook limits the amount of reading students may do in a subject and given the range of reading levels within a class it may not be an effective teaching approach. Teachers may identify textbooks that cover the same material as the course text but are written at lower readability level. They can also use a variety of resources that engage students, such as magazines, trade novels, picture books and the internet, to supplement

textbook information. Students must be able to take questionable source data and evaluate its reliability and form their own conclusions. Dayton-Sakari (1997) found that when students researched a content area of interest, the 'need to know' that they experienced encouraged reading. Student selection of materials allows them to exert some control over the reading and writing process. For a struggling reader the process being taught is at least as important than the content drawn on.

Activity Approach

Scruggs, Mastropieri, Bakken, & Brigham (as cited in Vaughn, Bos, & Schumm, 2003, p. 438) compared two approaches that taught science to middle school students. Improved outcomes occurred in measures of vocabulary, factual recall and the application of concepts for students taught through an activity approach. Those taught the same content through a textbook approach were not as successful. Students also overwhelmingly preferred the activity approach and commented that it was more enjoyable. Activity oriented instruction coupled with effective content area reading methods can increase student engagement and improve topic understanding. It provides greater opportunities for students who do not read and write well to be actively involved. To further the example used throughout this paper, the teacher can facilitate students' understanding of the concepts of 'weathering and erosion', by involving them in practical experiments that explore the effects of heat and water on soil and rocks.

CONCLUSION

An ideal learning environment as described in Queensland's Productive Pedagogies, and detailed in Hattie's research on effective feedback within the context of the constructivist approach underpinning the SACSA document has been outlined to provide a framework for the effective use of textbooks. Strategies for the classroom teacher, teachers generally within the school, and for students have been woven through the discussion in order to provide suggestions of ways to support those who learn differently within an inclusive learning environment.

In South Australia, text books are widely utilised in secondary schools to provide topic based information for students and to pose questions to test student learning. While the information in the text may be accessible to some students, in this new millennium and age of information, is it relevant to limit student focus to teacher selected texts? For students with difficulties in reading opportunities to access and explore their world and worlds imagined require the use of a wide range of sources and experiences in a self directed and success oriented classroom environment. The use of textbooks is one source of information that must be effectively managed and supported to enhance the achievement of all students.

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TECHNOLOGY AND TEACHERS IN RURAL SCHOOLS: DIVERSITY AND SIMILARITY

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Abstract

This paper reports on a project situated in regional Victoria in which 16 primary and secondary teachers participated in an intensive professional development program designed to assist them to embed Information Communications Technology (ICT) into their classroom practice. The results identified a diversity of circumstances, not only in terms of ICT availability and use, and teacher experience, but also related to general issues of curriculum planning and integration, size, communication, and pedagogical presumptions. The successful integration of ICT into pedagogical practice was influenced by complex factors including the availability of ICT resources, the teachers' ICT skill level, the teachers' ability and opportunity to integrate ICT in classroom, the level of support provided, both technical and pedagogical, and the curriculum requirements. Despite the constraints identified the results of the project have been positive with evidence of increased networking among teachers, changes in teaching practice and increased teacher proficiency and awareness of ICT resources. This project highlighted difficulties that teachers experienced including frustrations with the unreliability of technology and a lack of time for necessary training and preparation. In response to these constraints, teachers have been resourceful and inventive in developing pedagogical strategies to aid the integration of ICT into classroom practice.

INTRODUCTION

This paper reports on a project designed and conducted by the Association of Independent Schools in Victoria, (AISV). The project called *Using ICT to Support Literacy and Numeracy in Rural Schools* took place in 2006. The main goal of the project was to enhance teacher capacity through professional learning which targeted the teaching of literacy and numeracy supported by ICT for students in need. The AISV approached educational researchers at Deakin University to conduct an evaluation of this project. This paper provides an overview of the project and summarises the key findings of the evaluation.

THEORETICAL UNDERPINNINGS

There are three areas examined in this study:

- Pedagogy: The effective use of ICT in the classroom by teachers
- Resources: The ICT resources available in rural schools
- Professional Development – the format and the support of the instruction.

Many students are competent users of ICT, such as computers, the internet and CD-ROMs. Prensky (2001) has described individuals who have been brought up with computers and technology as 'digital natives' compared to for example teachers who have not grown up immersed in technology, who he refers to as 'digital immigrants'. There is no doubt that digital technology is influencing the way students use information and the way they learn (Elliott, 2005). The digital divide therefore impacts on teaching and learning. Schools have invested heavily in ICT infrastructure and provided professional development to teachers to enhance the use of ICT in classrooms, but this has not always been effective. Despite the fact that the literature recognises that ICT can have a positive effect on teaching and learning it is often under-utilised (British Educational Communications and Technology

Agency, 2004; Osborne & Hennessy, 2003). Teachers who lack competence and skills in using ICT are unlikely to risk using ICT in their classrooms (Levin & Arafeh, 2003). In tackling the digital divide the teacher plays a critical role "in creating conditions for ICT-supported learning" (Osborne & Hennessy, 2003 p.4). The integration of ICT into the curriculum is dependent on a number of factors including effective professional development (Chalmers, 2002) and teacher competency with ICT (Lim et al., 2003).

An Australian national survey (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006) reported on the difficulties faced by regional and rural schools attracting and retaining suitably qualified teachers, providing adequate professional development to teachers in remote and rural locations, and in the supply of resources and support for all students included gifted and special needs students. The report found that the problem with teacher ICT competence and ICT resourcing is exacerbated in rural areas. This data warrants the focus of professional development and support for teachers in rural and regional areas.

The short term 'skills and knowledge' approach to professional development (PD) in ICT that develops teacher skills in various applications has been shown to be quite ineffective in helping teachers to use ICT more effectively in their classrooms (Carrick, 1989; Hoban, 1992; Owen, Johnson, Clarke, Lovitt, & Morony, 1987). There is almost universal agreement amongst education researchers that long term PD that is sensitive to the needs of teachers and schools is necessary to support significant teacher development. Teachers need to ground new ideas in their own personal experience (Hall & Hord, 2001; Hargreaves, 1994) and situate professional development within the school context (Joyce & Showers, 1995). This approach reflects more accurately the emphasis of the Victorian curriculum (VELS) with ICT skill a dimension that is applied across all disciplines. Many writers (Hall & Hord, 2001; Hargreaves, 1994) have emphasised that change requires of teachers that they ground new ideas in their own personal experience. Joyce and Showers (1995), drawing on research from a large number of studies, argue strongly for the need to situate professional development within the school context.

THE DESIGN OF THE PROJECT

In response to the research literature reporting strong links between improved learning outcomes and the effective use of learning technologies as reported by Calnin, (2006), the AISV proposed the trialling of an intensive and sustainable professional development program in the use of ICT. The project was based in three regional hubs of Victoria – Gippsland, Shepparton and Hamilton. A number of schools within these hubs were invited by AISV to participate in the project. Teachers at these schools were nominated or invited to represent the school in the project. The project was designed to train, instruct and support staff at the participating schools throughout Victoria. Initial meetings between the researchers, consultants and selected teacher(s) at each of their respective schools allowed for an assessment of the schools resources and infrastructure as well as an evaluation of the participating teachers ICT skill level. Armed with this information, the consultants designed tailor made professional development programs for each of the three hubs. In addition infrastructure needs were ascertained and plans begun to address these needs (eg computers, Internet access, satellite provision, TLF licensing agreements, etc) prior to the commencement of the program. The AISV was active in assisting those schools with limited or no ICT resources in acquiring the resources necessary for participation in the project.

This professional development program was designed to support rural and regional schools by improving their access and use of ICT to enhance student learning in key curriculum areas. The cohort of schools varied with regard to degrees of advantage and disadvantage. The areas of spheres of difference advantage or need included socio-economic background, geographical isolation, size of the school, professional isolation, lack of resources, lack of availability of expertise or other factors. While there was no cost to each school, they were asked to commit to the following support:

- the release of one teacher for a 5-day intensive training program;
- the training of at least 2 staff by the 'trainer' during Semester 2, 2006;
- on-going professional learning activities for their staff beyond 2006 in the areas of literacy, numeracy and ICT;
- participation in the local network and in the end-of-year showcase;
- the writing of a report in the form of a case study or personal journey diary;
- participation in the research element of the project.

The teachers participating in the project assumed the role of coordinator for their school. They attended a five day intensive professional development course in *The effective use of Information Technology Communication (ICT) in the classroom* which focused on the skills and competencies necessary to integrate ICT effectively into teaching. An example of the program for one hub is shown in Table 1. A similar program was delivered at all three hubs, however it was adapted to the needs of the participating teachers. This intensive training program covered areas such as curriculum development, inclusivity, pedagogy and ICT integration in addition to introducing a variety of new skills such as blogging, using search engines and learning computer programs. This program was based on the pedagogical approach of integrating ICT seamlessly into teaching across the curriculum. It was not a program focused on mastering software applications. The teachers were required to assimilate new skills and ideas into their own unique learning situations. This requires thinking, application and creativity and time so that the ICT adds value to the learning tasks.

Table 1: The Schedule For 5-Day Intensive Professional Development Program For One Hub

Day	Content
1	What research says about effective use of ICT Curriculum frameworks – Victorian Essential Learning Standards (VELS), National Curriculum Council (NCC), Inquiry based learning.
2	The learning federation (TLF) learning objects and digital resources, interactive whiteboards Exploration of learning objects, and their pedagogical use Mathematics, numeracy learning objects Mathematics interactive web resources, Microsoft student, Graphical calculator
3	Digital storytelling Microsoft producer, photostory, movie maker Mid training exploration of use of resources in the unit of work that is to be created
4	Planning and support for unit of work creation Development of resources
5	Finishing touches to resources Presentation to group. Discussion of how to train others. Blockers to PD. Feedback session

Following the professional development intensive the coordinators were expected to implement changes in their own classrooms as well as providing professional development to colleagues at the school. In this way the program adopted a train-the-trainer approach; training the coordinators who would return to school to train others. The coordinators had a leadership role training two other teachers at their school in the skills and competencies which they had learnt during the PD. The coordinators were training other teachers, supported by the consultants. The consultants maintained support for each school throughout the six months of the project with on-line advice, e-mail support and two one-day visits per school to work with teaching staff on the development of their teaching programs. A showcase of teaching skills and curriculum innovations was held at each hub towards the end of the project. The outline of the project is presented in Figure 1.

THE RESEARCH QUESTIONS

The project had three major foci of examination - pedagogy, resources and professional development. It addressed the following research questions.

1. What are the particular circumstances in these rural schools and communities that affect the use of ICT in supporting teaching and learning?

2. What has been the impact of the PD and ongoing support provided through the project on
   i. teachers' confidence, capabilities and pedagogies in using ICT?
   ii. student use of ICT in the classroom?

3. What aspects of the PD model were successful in improving teaching and learning using ICT based approaches in rural areas?

RESEARCH INSTRUMENTS

Multiple data sources were collected to provide opportunities for the validation of proposed themes or issues through cross-referencing. Both qualitative and quantitative data were collected to provide an overview of issues as well as specific individual case studies (Altheide & Johnson, 1994). The data sources included:

- interviews with participating teachers, consultants, and selected students;
- focus group discussions with coordinators and teachers;
- analysis of student work samples in relation to ICT and literacy and numeracy;
- questionnaires completed by coordinators, participating teachers, and principals;
- field notes based on classroom practice, and workshops;
- questionnaires completed by coordinators, teachers and students.

Given the small sample size, the analysis of quantitative data was limited to descriptive statistics only. Quantitative data was transcribed and coded where necessary. Each school and coordinator presented a unique situation which necessitated that each context was compared to its own position before the project and not to other schools or coordinators. Pseudonyms for schools and districts are used in this paper.

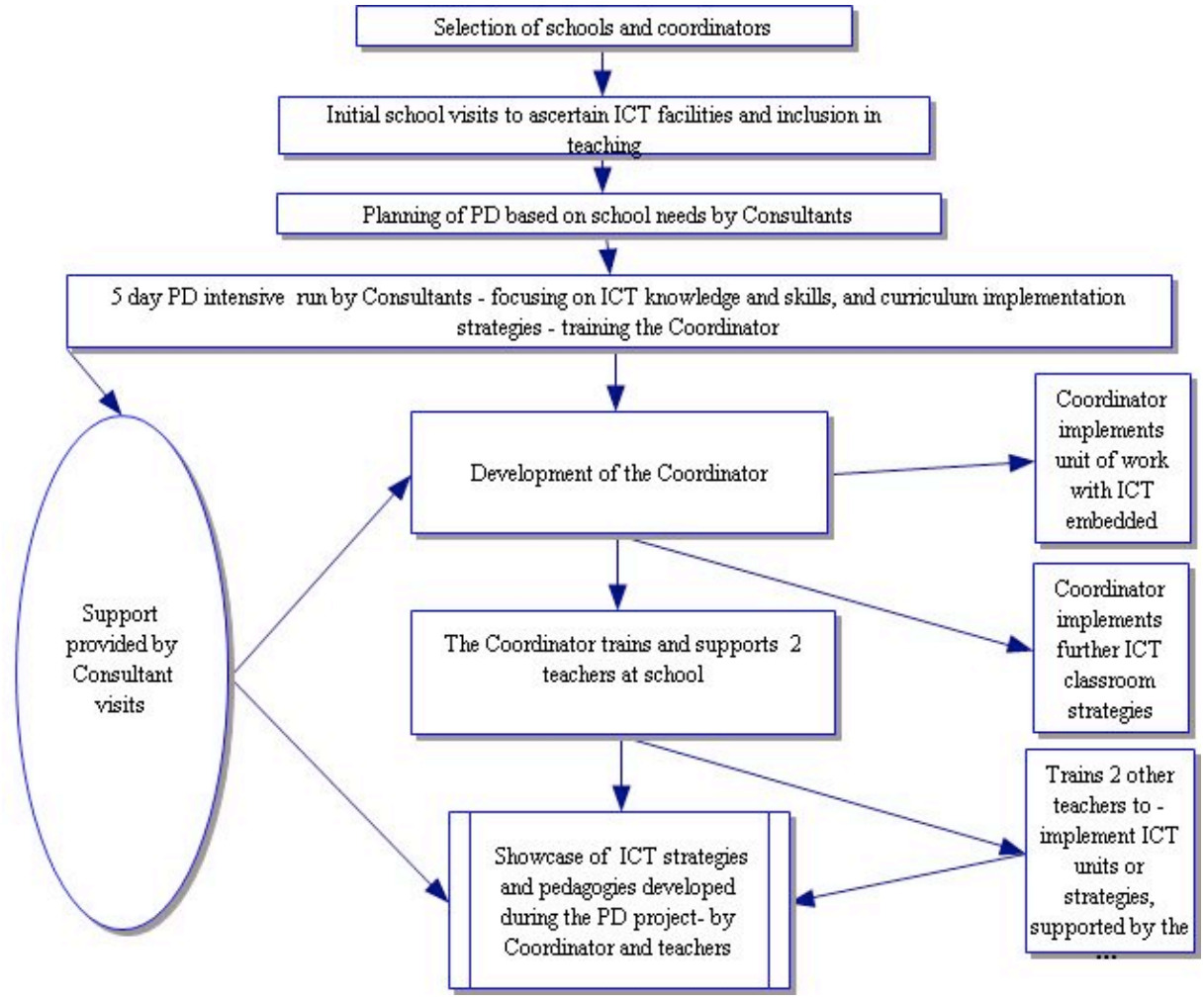

Figure 1: Diagrammatic representation of the PD program

SETTING

The initial data provided a description of each school and an overview of the whole group. The schools were diverse in terms of size, religious affiliations, location, resources, and ICT facilities. There were 4 secondary schools, 4 P-12 colleges, and 5 primary schools. Of the 13 schools': 5 were small (<100 students), 4 medium (100-300 students), 2 large (>600students). Some schools were located in large regional towns, while others were from more remote locations.

The sophistication of resources, such as the age and number of computers, accessibility, support, software, and internet speed varied enormously, (e.g. from a large very well resourced P-12 school (900 students) with wireless Internet, Smart boards, data projectors, 500 computers, where all staff have laptops to a small P-6 school of 23 students with no operating computers in the classroom at the time). The use of ICT in the schools also varied. There was a variety of support for PD and innovation from school administrations. Lastly the curriculum policies for the use of ICT varied from informed and detailed to none.

Despite the high level of ICT resources at some schools the integration of ICT was not guaranteed. There was little evidence of integration of ICT with other discipline areas at any schools. Prior to this project, there were few connections between the schools at the three hubs. The commitment to the project by various participants also varied. The backgrounds and ICT skill level of the coordinators was diverse. Some were responsible for teaching and managing ICT in their schools, others were selected because of their lack of ability in ICT.

Two thirds of the co-ordinators indicated they used computers to: create diagrams, send email, create presentations, research using the Internet, use a scanner and a digital camera. Fewer teachers had previously used or created spreadsheets or digital videos. Six out of fifteen teachers had definite ideas about using ICT in units of work they were planning or developing.

A frequently mentioned expectation from the coordinators was that the PD should result in general improvement of teacher's ICT skills and a better understanding of how those skills might be used in classroom practice. The most frequently mentioned criterion for success was that the PD should result in transformative leadership.

RESULTS

The successful integration of ICT into teachers' pedagogical practice was influenced by a complex of factors including the availability of ICT resources, the teachers' ICT skill levels, the teachers' ability and opportunity to integrate ICT in their classrooms, the level of support provided at the school level, both technical and pedagogical, and curriculum requirements.

The results of the project however, have been overall very positive with evidence of increased networking among the teachers changes in their teaching practice and increased teacher proficiency and awareness of ICT resources. In some cases coordinators demonstrated considerable innovation and leadership skills, whereas for others, either confidence or lack of initiative seemed to impede progress. The support of the principal was also a major factor in setting realistic expectations of the coordinators, and other staff, relating to the extension of PD within the school.

The results of the project also highlighted some of the common difficulties teachers experienced including frustrations with the technology and its reliability and a lack of time for necessary training and preparation. In response to the constraints, teachers have been resourceful and inventive in developing pedagogical strategies to aid the integration of ICT into their classroom practice. For example students were trained to ask three other people before asking the teacher, and they had a buddy system where fellow students helped each other. The skill of being a problem solver and a risk taker was recognised and applauded. Students in one class were encouraged to keep a journal of their frustrations and accomplishments on the computer. Through their logs students provided critical evaluations of software programs.

The diverse cohort of schools meant that there was a large diversity of circumstances experienced by the schools in the project, not only in terms of ICT availability and use, and teacher experience, but also with regard to more general issues related to the culture of curriculum planning and integration, size of the schools, communication, and pedagogical practice. The results provide evidence of the complexities of the relationship between curriculum, ICT and learning, and the difficulties inherent in effecting change in the use of technology in the curriculum and in teachers practice. Five aspects of the project are discussed in detail to illustrate the challenges of facilitating the embedding of ICT in classroom practice:

- The PD program
- Implementing change in the classroom
- Student learning and practice
- Training other teachers
- Integrating ICT

The PD Program

Teachers' responses to the survey indicated a very high level of approval about most aspects of the 5-day intensive PD program. For example, teachers responses (shown in brackets) to an open-ended question from the survey , namely: "What is the most useful and/or valuable thing that you have learned in this PD?" related to three areas as shown in Table 2

The teachers appreciated that the PD was tailored to the individual needs of each coordinator. They valued the time they had to explore and trial ICT resources. As part of the PD, teachers reflected on a daily blog. This gave the teachers experience with blogging and provided each coordinator with an opportunity to be reflective about the day's experience and also provide feedback to other teachers in their hub. In this way the PD was modelling reflective practice that promoted metacognition. All the coordinators appeared to write openly and honestly about their feelings of insecurity, fear, success and failures. This is demonstrated in the excerpt shown in Figure 2 which is a typical example. The success of the blog for each hub after the 5 day instruction varied. The most successful blog provided an ongoing communication channel for the group until the end of the year.

Table 2: Teacher Responses Identifying The Best Aspects Of The PD

Category	Number of Responses	Example
Acquiring technical knowledge and skills	13	resources, software packages (folio, photo story) and web sites
The pedagogy of using ICT	5	models of teaching, varied presentations, how to integrate ICT, working with the available resources and including ICT in curriculum planning
The nature of the PD	3	having small group support, a full week, and guidance and support.

The intensive training period of five consecutive days, with small group size and personalised instruction, while very expensive, proved to be the significant feature of the program. The allocation of this time communicated to the schools and teachers the importance of the project and recognised explicitly the importance of investing in teachers by providing significant time for training, learning new skills and developing new curriculum programs which incorporated ICT. This time was essential in giving each teacher time to learn and practice new skills, build relationships with other participants and gain confidence in using their new skills.

Day 1 blog	*"...a great day!! WOW! SO much exciting information. Can't wait to show the others at school." …"...the children will delight that I have had to be a student again".*
Day 2 blog	*"feeling less nervous about the course today but totally embarrassed with what I don't know!! (morning)...really enthused and excited with this afternoon's session. Look forward to tomorrow.(afternoon).*
Day 3 blog	*"started out feeling confident...frustrations with my computer...my confidence and enthusiasm waned...what I had in my head when you first showed us, was not what I could remember an hour later...others were all excitedly showing their photo slides!!! I wanted to make a quick exit to the Ladies to have a cry and say I had reached my limit .. told myself not to cry and worry others and do what I encourage my students to do – stop what you are doing, take a deep breath, remind myself that I haven't got it this time I can try again later and then get back onto the bike...I am still daunted and feel inadequate to meet the challenge.*
Day 4 blog	*I keep thinking how wonderful it would have been for our graduate teacher to be here who is technologically proficient and would have picked this up so quickly. I am so disappointed in lack of ability to pick this up.*
Day 5 blog	*Going through the pain barrier yesterday was hard but I'm glad I persevered. I really started to get into it last night and enjoyed it.*

Figure 2: An excerpt from a teacher's blog during the PD

Implementing Change in the Classroom

Participation in the project influenced all the teachers' practice. Identifying change in teaching practice was not dependent on the range or frequencies of the ICT resources. Small changes can be equally as significant as large changes. For example one teacher was provided with a Smartboard as a direct result of being involved in this project. She developed many ways of using it in a Preparatory-grade class. Another teacher, at a school with more limited resources, used a data projector in the class for the first time. She also used the mobile mouse – having students taking turns to interact with the task on the screen - with her class working collaboratively as a group. Evidence of the extent of teachers' use of ICT, comes from three teacher's blogs:

Sarah: In my class I am using ICT rotations in literacy and numeracy, and the children go to the computer lab once a week. So I think it s generally incorporated through and it overflows into their integrated studies. It's all built in.

Roslyn: The students are spending at least 1 period in the computer lab each week and 3 periods in our mini-class lab. They are busy publishing narratives, making an Excel data-base about dogs and their suitability as family pets, trialling Mark Hennsessy's Switch on Maths units, and Photo-story 3 to recount School Showcase. I set up the task in the main lab, and the students work on completing these tasks throughout their mini-lab time.

Rae: I was always competent but didn't know how to do it. Now it's an integral part of my teaching. There's hardly a class where I don't do something with ICT … I use it all the time people think preparation of curriculum takes more time with tech. This is true initially but you need to convince them that in the long term time is saved.

While all participants reported being influenced by the project positively, there was variation in the degree of implementation of the project objectives by the participants. Not all coordinators completed all the objectives of the project. Table 3 shows that approximately half (7/15) of the coordinators taught a planned unit of work. Twelve out of fifteen of the coordinators provided some form of PD to the staff at their school, and one third of the coordinators had the next generation – the teachers trained by the coordinators – at their respective schools - and then teaching planned units of work.

The application and success of the participants were not dependent on the resources available at the schools. There are examples of teachers from very well resourced schools using this time to learn how to use an Interactive Whiteboard (IWB) and equally there are examples of teachers learning to make better use of their school's one data projector. The application and success of the participants was influenced by internal factors at an individual level and external factors relating to the school and situation.

The internal factors include:

- their own motivation,
- their recognition that their effort will add value to their teaching
- willingness to instigate change.

The external factors include:

- the reliability and availability of the resources at the school,
- the attitude of the other staff and principal, and
- the allocation of time to complete the expected training and continued learning.

The variation in the "change" that occurred in teachers' practice and the completion of the objectives by the participants is demonstrated by the following examples of variation:

- Information regarding widely varying resources such as server access, speed, resources, and licensed software application issues that were available to the coordinators in their schools. Some schools had limited resources, no ICT organization and infrastructure, and inconsistent support.
- The expertise of the co-ordinator in being able to move on from the PD instruction varied enormously.
- The situations facing coordinators in implementing the program in their schools were varied in terms of complexity. No time was allowed at school for the instruction of teachers by the coordinator.
- In some cases coordinators demonstrated considerable innovation and leadership skills, whereas others made little progress because of either a lack of confidence or lack of initiative.
- The support of the principal was a major factor in setting expectations for the coordinators and other staff regarding the extension of the PD within the school.
- Fitting the project into an already crowded curriculum was a challenge in terms of - adapting and integrating the ICT components.

Table 3: Extent Of Implementation Of The Pd By Coordinators (N=15)

Coordinator planned and taught ICT Unit	Coordinator implemented new ICT sequences	Coordinator conducted PD to other staff at home school	Coordinator supports training of teachers to develop and trial unit of work with ICT
Yes (7) No (8)	Yes (8) Partial (2) No (4) Unclear (1)	Yes (6) (supporting 12 teachers –being trained at school in ICT Partial (6) No (3)	Yes (5) Partial (3) No (7)

Student learning and practice

As expected, data showed there was an increase in the variety and frequency of ICT used by students as a result of their teachers' involvement in the project. A wide variety of applications were used, in a variety of classes and situations which was not the case before the project. For example, Photo-story, Kidpix, Html files and Animation. Interviews with selected students showed how they had become familiar with programs and were able to pass critical comment about the hardware and software they were using.

For example:

Grade 4 student: *We have been making animations using lego … so we have been making photos of the …. with digital camera so far my group has made two movies – just normal lego and we take photos and go into windows moviemaker and cut to one second. We made a movie that lasts 10 minutes.*

Some students kept a journal recording critical evaluations of the software programs they used. Two examples are shown in Figure 3 and Figure 4

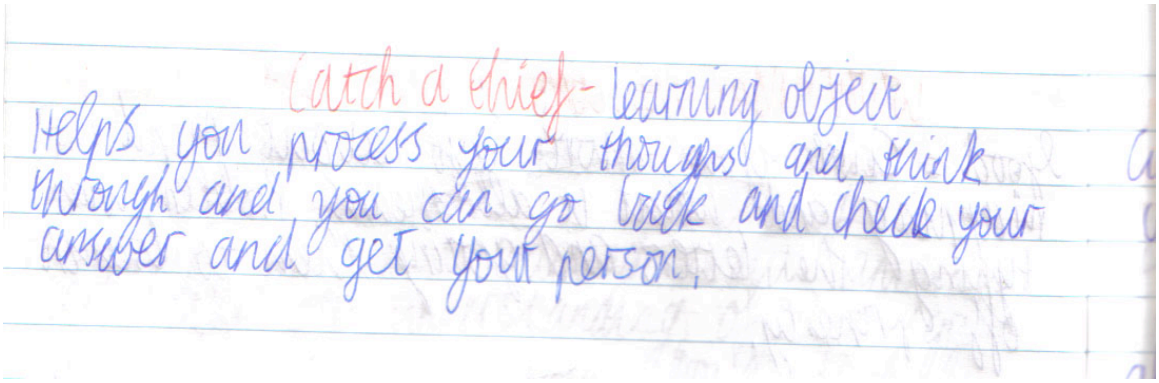

Figure 3: A student's comments in his journal on the learning object program called "Catch a Thief"

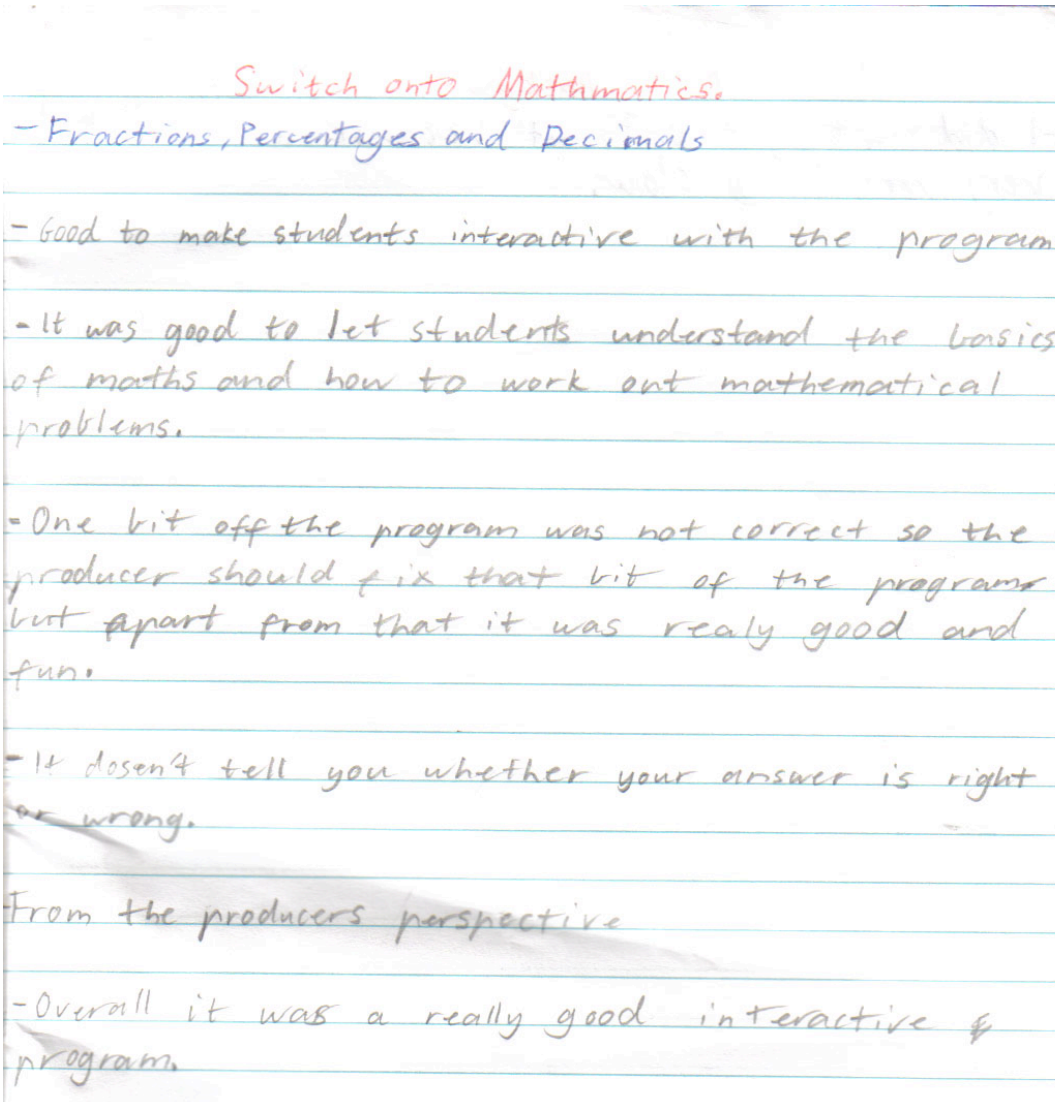
Switch onto Mathmatics.
- Fractions, Percentages and Decimals
- Good to make students interactive with the program
- It was good to let students understand the basics of maths and how to work out mathematical problems.
- One bit off the program was not correct so the producer should fix that bit of the program but apart from that it was realy good and fun.
- It dosen't tell you whether your answer is right or wrong.
From the producers perspective
- Overall it was a really good interactive program.

Figure 4: Grade 6 student writing about Switched on Mathematics Program

Training Other Teachers

Only 6/15 coordinators implemented full training sequences with teachers at their school. There are a variety of common factors identified from the data to have contributed to the lack of success of the PD. These factors can be classified as general and ICT related. General factors included:

- a lack of support from the school administration with no allocation for time, space or training;
- miscommunication - with some coordinators not understanding their role in training other staff;
- changes in the circumstances either of the school or the coordinator.

ICT factors including:

- financial constraints limiting the availability of new resources;
- a lack of confidence and experience in the coordinator to use and teach ICT
- not seeing a need to show other teachers (at very well resourced schools) because they were already very computer literate.

The six successful coordinators worked within their individual schools' unique conditions and constraints to successfully train other staff members. All successful coordinators demonstrated the enthusiasm and determination during their training. For example some teachers held classes at lunchtime and in the holidays. Others had sessions after school. The coordinators displayed leadership by providing instruction to teachers and helping them implement ICT into their teaching programs. This was exemplified by the coordinator co-teaching with other teachers, sharing new resources and techniques e.g. blogging, smartboard, photostory etc. The success of the training program was dependent on the enthusiasm, leadership and computer skills of the coordinator.

Some teachers were resistant to using ICT because of a lack of expertise and confidence. Some teachers being trained also expressed concern about initiating change, fearing a resulting lack of control in their classroom, for example:

Teacher 1: *I felt quite intimidated by the whole setup and I didn't feel I had the skills to handle a crisis and when things were going wrong I didn't know the steps to help the children so it was in the too hard basket*

With limited ICT experience, most teachers (being trained at school) had previously used ICT in the classroom as a reward, motivator, or time filler. They did not really regard ICT as a sound learning tool. Some teachers expressed concern about the importance placed on ICT in the early years of learning when the focus is justifiably on numeracy and literacy. This is illustrated by the following quote.

Teacher 2: *The other problem that I have is that with the junior primary children I just believe that it is so important that they get literacy basics and that is what I see as my goal, the computers are just an extra bonus for them. If they are good on the computer but can't read and write independently then I just feel that I don't want to take up any extra time on the computer but I do want to supplement what I do on the computer – but need reliable computers.*

This comment from a teacher at a small community school demonstrates the professional and careful consideration the staff gave to the school's participation in the project. The time needed had to be negotiated with consideration placed on all important learning opportunities.

Integrating ICT

The role of ICT in the classroom has changed dramatically over the past decade and an important focus of the PD was in understanding the role of ICT in promoting learning through alternative curricula formats. The Victorian Essential Learning Standards (VELS) curriculum reflects this approach with ICT a learning domain that extends across the whole curriculum. Students often have more experience with computers and have better skills than their teachers. Some teachers lack confidence in their own computer skills, and are not prepared to take risks in their classrooms. The PD intentionally distinguished ICT technological skills from ICT pedagogical skills drawing on each teacher's pedagogical experience, and encouraging them to identity software and applications that could be used effectively in the classroom to promote learning.

The results of this project have highlighted that teachers need time to develop their own computer skills and learn specific software and applications. Teachers must be willing to using ICT in the classroom which may range from teaching computer skills to children, to acquiring pedagogical content knowledge concerning the effective use of ICT.

CONCLUSIONS

There was a surprising and extreme variation in the level and quality of ICT facilities available in the rural schools. Generalizations cannot be made about the schools because even for this small sample there was diversity of situations with respect to wealth, resources, organisation and teacher skills. The particular circumstances in these rural schools and communities that affect the use of ICT in supporting teaching and learning of literacy and numeracy include the availability of ICT resources (which was found to be more to do with the wealth of school rather than the rurality); support from the school; access to both technical and pedagogical expertise in ICT and the teacher's attitude to the use and role of computers in the classroom.

The successful integration of ICT requires teachers to be confident ICT users. Through this project all coordinators improved their ICT skills and some developed their leadership skills. These results correspond to teachers' expectations expressed at the beginning of the project. The development of ICT pedagogical content knowledge was a key outcome, with teachers developing ways of using and integrating the ICT into their teaching, such as the use of the interactive whiteboard, animation, and digital stories. As a result of teachers increased use of ICT, student's use of ICT in the classroom also increased.

The development of the ICT pedagogical content knowledge requires situated learning whereby teachers can learn ICT skills and apply them to their particular teaching and learning situations. By combining their pedagogical expertise with developing ICT expertise teachers can create new learning opportunities for students that are inclusive of the ICT resources available, students skill level, teacher's confidence and curriculum requirements. The intensive five day PD was valued for providing this opportunity.

The project included a train-the-trainer component with the coordinators undertaking intensive training and the being responsible for training two other teachers. This approach was not always appropriate or achievable. The aspects of the train-the-trainer model that promoted change included having a colleague (the coordinator) ready to provide instruction and support; working with other staff with the same goal; having online and ongoing support from the consultant and the need for initiative and leadership by the coordinator. The aspects of the train-the-trainer model that made it not viable for some coordinators included the variable support from the school, a lack of understanding by the coordinator of their role in training other staff; and a lack of confidence, ability and expertise to teach other teachers in the use of ICT after a five day PD program and a lack of recognition by school leadership of the additional responsibility. The design of the project intended coordinators to learn new skills and share and communicate their new knowledge to colleagues. Fewer than half of the coordinators successfully trained other teachers at their own schools. The limited success of the train-the-trainer aspect of the project is disappointing and has highlighted the difficulties in meeting the professional needs of teachers in rural and regional locations.

The success of the PD and ongoing support provided by the project was variable, and needs to be considered on an individual basis by identifying specific school-based reasons for success and failures. The five day intensive instruction program was valued highly by all coordinators and resulted in an increase in the ICT skill level of all coordinators. The extent of the change to teaching practice varied according to individual teacher's motivation and attitude, willingness to change, in addition to the constraints of particular situations, school support and allocation of time. The intensive PD being held at each hub provided a networking opportunity for participating teachers in the same rural areas and in some cases resulted in ongoing relationships between teachers at different schools. Many of the schools were sites of innovative practice, both in the classrooms of the coordinators, and in other classrooms as a result of PD or simply information dispersal in schools following the PD. There were many students with increased exposure to software and increased use of

computers in generative ways. The nature of the way ICT was used by teachers and students was significantly changed in the majority of schools.

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THE IMPACT OF A MATHEMATICS TUTORING PACKAGE ON RURAL SECONDARY STUDENTS' ATTITUDES TO MATHEMATICS

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Abstract

This paper reports on a brief trial of the MathsPOWER program with students in a relatively remote rural Tasmanian secondary school. The program was offered to 73 grade 10 students as an additional resource to use at home as they chose. Of the 44 students who took the software 23 reported using it very little or not at all. The program was also used in class with a small group of students with learning difficulties and appeared to be of potential value as an addition to teachers' repertoires in this context. The study provides insights into the attitudes to mathematics of students in a rural secondary school and the difficulties faced by teachers attempting to motivate students with a view to improving their mathematics outcomes. It offers salutary lessons about maximising the effectiveness of interventions such as this.

INTRODUCTION

Despite its varying definitions attitude is commonly characterised as including an emotional element and hence lying between beliefs and emotions on the affective spectrum postulated by McLeod (1992). Attitudes are also regarded as influencing intentions to act and hence behaviour, and as dependent on beliefs (Ajzen & Fishbein, 1980) and experience (McLeod, 1992). Ma and Kishor (1997) described attitude to mathematics as a multi-dimensional construct including a like or dislike of mathematics; an inclination to engage in or to avoid mathematics; beliefs about whether one is good or bad at mathematics; and beliefs that mathematics is important or unimportant, useful or useless, easy or difficult. Further possible dimensions include confidence or anxiety toward mathematics (Ernest, 1988) and interest or disinterest in the subject (McLeod, 1992). Thomson, Creswell and De Bortoli (2004), in their analysis of Australian students' mathematical literacy performance in the Program for International Student Assessment (PISA, 2003) discussed aspects of attitude to mathematics examined in that study. They found a strong positive association between mathematical literacy performance and mathematics self efficacy (defined as confidence to complete a range of mathematical tasks), and a moderately strong association between performance and mathematics self concept (i.e., beliefs about one's own mathematics ability). Relatively weak associations existed between performance and interest in and enjoyment of mathematics, and with instrumental motivation (beliefs in the utility of studying mathematics in terms of such things as finding a job). Mathematics anxiety was negatively associated with mathematical literacy performance. In addition to its links with performance, fostering positive attitudes to mathematics among students is a worthy goal in itself.

The potential of technology to enhance the teaching and learning of mathematics has been recognised for some time (e.g., Swadener & Blubaugh, 1990). More recently the imperative, presented by technology, to rethink the content of mathematics curricula and the ways in which mathematics is taught have been acknowledged (National Council of Teachers of Mathematics (NCTM), 2000. The NCTM (2000) framed their assertion of the important role of technology in mathematics teaching in terms of a concern that mathematics be taught for understanding. Such concern for understanding rather than for procedural efficiency alone is common in the mathematics education literature (e.g., Carpenter & Lherer, 1999). It was the NCTM's contention that appropriate use of technology could deepen students' mathematical understandings. Similarly Grouws and Cebulla (2000) recommended that technology be used to develop understanding rather than for low level tasks such as checking the results of paper and pencil calculations.

Despite the emphasis in the literature concerning the use of technology to promote understanding, Kleiman (2000) claimed that many school computers are not being used in ways that enhance learning. He attributed this to a range of factors including inadequate teacher training related to pedagogical issues around incorporating computer use into teaching. The result is computer use focussed on rewarding fast finishers, drilling of basic skills, and occasional one-off activities (Kleiman, 2000). Owens and Perry (2001) cited evidence that computer use can change teaching but that change can take considerable time and is dependent upon the constant availability of computers and helpful interactions between teachers and support staff. They observed that studies that have produced positive evaluations of the potential of computer programs to develop students' understandings have featured teachers taking a prominent role in initiating interaction with and between students with a view to promoting higher order thinking and metacognition.

Computers can assume a number of roles in classrooms. The role of computers in the study reported here can best be described as computer as tutor (Taylor, 1981 as cited in Goos & Cretchley, 2004) in that it acted as an Integrated Learning System (ILS) providing instruction in the form of graded individualised tasks and feedback (Goos & Cretchley, 2004). McRobbie, Baturo, and Cooper (2000) highlighted shortcomings in the effectiveness of such systems with low achieving grade 8 students. They questioned the ability of the ILS adequately to diagnose students' learning needs and to provide appropriate feedback. In addition, they noted the lack of alignment between theories of learning that underpinned the design of the system and which placed students in the role of recipients rather than constructors of knowledge, with current theories of mathematics learning. In contrast to studies cited by Owens and Perry (2001) as exemplifying successful use of computer software, McRobbie et al. (2000) pointed to the limited role afforded teachers by the ILS due to the closed nature of the tasks it provided. Goos and Cretchley (2004) made the point that the theories of learning underpinning the design of software are crucial to the outcomes it achieves. It seems unreasonable, therefore, to expect outcomes consistent with calls for understanding (e.g., Carpenter & Lehrer, 1999; NCTM, 2000) unless the particular software is designed from a stance that equates learning with the development of understanding. Kleiman (2000) also noted that diverse goals motivate the use of computers in classrooms. Among the most common is that which was a major contributor to the decision by the teacher in this study to trial the software, namely to improve students' basic mathematics skills.

A further reason for the use of computers in classrooms is the belief that they motivate students by providing for individualised learning and allowing greater student autonomy (Kleiman, 2000). Fluck and Robertson (2002) provided evidence that students do find computer mediated tasks more engaging than tasks that do not involve the use of computers. Motivation to learn has been regarded as inseparable from cognition in contributing to a disposition to think (Grotzer, 1996) and as an inclination to behave in a particular way that is linked with self-regulatory mechanisms by which emotion is controlled (Hannula, 2006). Motivation is thus a complex construct most helpfully conceptualised for the purpose of understanding the results of this study as an outcome of the interplay between an individual's goals, needs, and the means by which he/she goes about achieving and meeting them (Hannula, 2006). In her commentary on Hannula (2006), Rodd (2006) highlighted the particular relevance of motivation for students with special needs and pointed to the potential of mathematics software to contribute to the achievement of teachers' goals for their students' mathematics learning by bringing closer together the social and learning needs of students.

THE STUDY

Context

Kilpatrick and Abbott-Chapman (2002) noted that although youth in rural northern Tasmania (also the site of this study) shared nationally observed priorities placed on work or study immediately following the compulsory years of schooling, they were potentially limited by their perceptions of what was possible for them. They observed that young people from rural communities, "are over-represented in the most disadvantaged labour market group – those who have not participated in post-school training and who have experienced long periods of unemployment" (Kilpatrick & Abbott-Chapman, 2002 p.43). Variations with geographic location in the mathematics and science achievements of Australian students has also been reported (Thomson et al., 2004) with provincial students achieving at lower levels than their metropolitan peers. Lyons, Cooksey, Panizzon, Parnell and Pegg (2006) pointed to a range of possible cause of underachievement in rural schools. These included a higher proportion of teachers teaching subjects other than those for which they were prepared, and the greater need, due to small student numbers, for classes including students studying more than one syllabus or subject. One respondent, a science teacher from NSW, described the negative impact on students' motivation of these arrangements in terms of "significant pressure on them to under-perform" (p. 131). There is also evidence that in rural schools, difficulties catering for the diversity of student learning needs are exacerbated by factors including limited access to support personnel, and professional learning focussed on catering for diversity (Lyons et al., 2006).

The school in which this study was conducted is located in a rural and relatively isolated area in the north west of Tasmania. According to Grey (2007) 2001 census data indicated that just 9.4% of employed people in the region held a university degree compared with 15.1% for Tasmania overall and 18.7% nationally. The Bureau of Transport and Regional Economics (BTRE) (2004) cited data from the same census placing the particular area within north western Tasmania in which the school was situated as having less than 8% of residents with bachelor of higher degrees. The school is the only government secondary school in the area with the nearest similar school approximately 60 km away. The school caters for students in grades 7-10 and offers a limited number of principally vocational courses at grades 11 and 12. Students wanting to pursue an academic pathway in the senior secondary years either attend the local K-12 private school or travel some 80 km to the nearest government and Catholic schools offering comprehensive programs at this level. The teacher who instigated the study is the second author and a mathematics/science specialist in the early part of his teaching career.

Aims

The study was motivated by the teacher's concern to be able to meet the diverse needs of students in mathematics classes. In addition, many students seemed unmotivated. Consistent with Lyons et al. (2006) report on regional and rural schools, the teacher also described significant discipline problems in the school. Several students had inquired about the availability of some tutoring software for mathematics so, following a search for suitable resources, the MathsPOWER software was identified as worthy of a trial. The specific research questions that the trial sought to address were:

1. What are rural year 10 students' attitudes to mathematics?
2. Does use of MathsPOWER improve students' attitudes to mathematics?

The Software

MathsPOWER is an Australian computer based audio-visual mathematics tutoring program. It provides online diagnostic assessment leading to a recommended program. The program is delivered via a CD Rom and printable worksheets. The program consists of a series of 3-4 minute lessons presented as narrated power points in which the content is explained, and accompanying worksheets in which each lesson applied. Regular tests, called examinations, are also provided and telephone tutorial assistance is available if required. Table 1 shows part of the lesson list or grades 9 and 10. In all there are 46 lessons listed prior to examination 1 with the total set of lessons for these grades including five examinations.

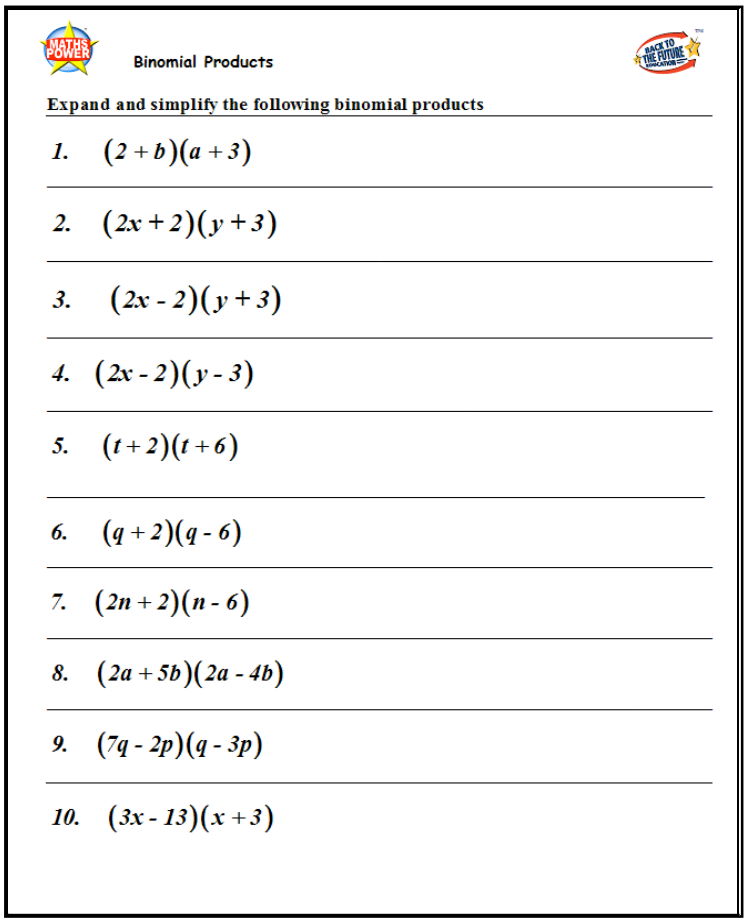
A sample worksheet, downloaded from the MathsPOWER website, http://www.mathspower.com.au/Pages/SampleLessons.asp, is shown in Figure 1.

The program emphasises mastery of successive small chunks of mathematics content and is claims to cover all of the material included curricula in all Australian education jurisdictions.

Table 1. Partial lesson list for grades 9 and 10*

MEASUREMENT	Review - Perimeter, area and volume
Surface area, Volume	Surface area of prisms
	Surface area of cylinders
	Surface area of composite solids
	Volume of prisms
	Volume of cylinders
	Volume of composite solids
	Application of measurement
	Surface area – pyramid, cone, sphere
	Volume - pyramid, cone, sphere
RATIONAL NUMBERS	Index Laws - adding and subtracting
Indices	Index Laws - multiplying and dividing
	Index Laws – the zero index
	Negative indices - adding and subtracting
Fractional Indicies	Negative indices - multiplying and dividing
	Fractional indices
	Evaluating Fractional indices
Scientific Notation	Scientific (Standard) Numbers - Multiplying and dividing
	Scientific (Standard) Numbers -Numbers less than 1
EXAMINATION 1	Revision Assessment

* downloaded from http://www.mathspower.com.au/Pages/SampleLessons.asp



Binomial Products

Expand and simplify the following binomial products

1. $(2+b)(a+3)$
2. $(2x+2)(y+3)$
3. $(2x-2)(y+3)$
4. $(2x-2)(y-3)$
5. $(t+2)(t+6)$
6. $(q+2)(q-6)$
7. $(2n+2)(n-6)$
8. $(2a+5b)(2a-4b)$
9. $(7q-2p)(q-3p)$
10. $(3x-13)(x+3)$

Figure 1. Sample worksheet

Participants

Seventy three grade 10 students were offered the opportunity to participate in the trial of MathsPOWER. Of these 44 opted to take home the CD and accompanying worksheets that had been compiled into a booklet. The software was used in class with an additional three grade 10 students with learning difficulties.

Questionnaire

The questionnaire, "What do you think about Maths?", comprised 32 items requiring responses on a 5-point Likert scale from Strongly Agree to Strongly Disagree. Eight aspects of attitude to mathematics identified in the literature were included with four items, some negatively worded and others positively worded, designed to measure each aspect distributed throughout the questionnaire. Table 2 shows the relationship between aspects of attitude targeted by the eight groups of questions and the aspects of attitude discussed by Thomson et al. (2004). All aspects reported on by Thomson et al. (2004) were included along with students' tendencies to engage with or to avoid mathematics.

Table 2. Comparison Of The Attitude Questionnaire With Aspects Discussed By Thomson Et Al. (2004)

What do you think about Maths?	Thomson et al. (2004)
Easy/difficult	Mathematics self efficacy
Good/bad	Mathematics self concept
Like/dislike	Interest and enjoyment
Interesting/not interesting	
Useful/useless	Instrumental motivation
Important/unimportant	
Confidence/anxiety	Mathematics anxiety
Engage/avoid	

The questionnaire was administered to students who were invited to participate in the MathsPOWER trial prior to and following the use of the program for one school term. Two open-response questions were added for the second administration. These were, “Give reasons why you have/have not used this resource?” and, “If you used the MathsPOWER tutoring CD, what do you think about it? Give positives and negatives.”

RESULTS AND DISCUSSION

The attitude questionnaire data from the 70 of the 73 students invited to participate in the MathsPOWER trial are shown in Table 3. Thirty six of the respondents were male and 34 female. The number of valid responses for items ranged from 68 to 70. The categories, Agree and Strongly Agree, and Disagree and Strongly Disagree have been combined to aid clarity and the items have been grouped according to the aspect of attitude to which they were intended to relate. The item numbers indicate the positions of the items on the questionnaire. Positively worded items were scored such that 5 indicated strong agreement and 1, strong disagreement. Items that suggested a negative attitude (italicised in Table 3 but not on the actual questionnaire) were scored in reverse so that in all cases a higher mean indicates a more positive response. Fourteen of the items were used and scored in the same manner by Beswick, Watson and Brown (2006). Their study involved 650 students in grades 5 to 8 from nine rural Tasmanian schools, none of which were in the north west region nor as far from a major centre as the school in this study.

Table 3. Frequency And Descriptive Statistics For Items Of The Attitude Questionnaire

Attitude Aspect	What do you think about Maths?: Items	SA or A (%)	Undecided (%)	D or SD (%)	Mean	Standard deviation	Mean (Beswick et al., 2006)
Easy / difficult	5. Maths is the easiest subject at school.	10.0	14.3	75.8	**2.16**	0.99	
	13. *Maths is a difficult subject.*	52.9	25.7	21.4	**2.63**	1.11	
	21. *The problems in maths are nearly always too difficult*.	24.3	20.0	55.7	**3.31**	1.03	**3.59**
	29. Most of the time I find maths problems too easy and unchallenging.	12.9	21.4	65.7	**2.29**	1.01	**2.60**
Good/bad	3. I think I am fairly good at maths.	41.2	30.9	27.9	**3.12**	1.13	
	11. I find most problems in maths fairly easy.	24.6	30.4	44.9	**2.74**	0.99	
	19. *I don't feel very sure of myself when I get an answer to a problem*.	25.7	37.1	37.2	**3.11**	0.94	
	27. *I don't do very well at maths*.	44.9	15.9	39.1	**2.84**	1.26	**3.44**
Like/dislike	1. I like mathematics lessons more than any others.	8.6	18.6	72.9	**2.16**	0.94	
	9. *I really do <u>not</u> enjoy maths lessons*.	37.2	25.7	37.1	**2.91**	1.27	**3.49**
	17. I enjoy attempting to solve maths problems.	48.6	22.9	28.6	**3.19**	1.15	**3.55**
	25. *Maths is <u>not</u> my favourite subject*.	67.7	17.61	14.7	**2.13**	1.13	
Interesting / uninteresting	8. I find maths a very interesting subject.	24.3	30.0	45.7	**2.69**	1.12	
	16. *Maths is a dull and uninteresting subject.*	37.7	33.3	29.0	**2.88**	1.13	**3.56**
	24. My interest in maths means I want to know as much about it as possible.	34.7	31.9	33.3	**3.04**	1.18	
	32. *Maths is the least interesting subject*.	34.8	36.2	28.9	**2.87**	1.21	
Useful/useless	4. Maths is a very worthwhile and necessary subject.	79.7	18.8	1.4	**4.10**	0.75	
	12. Maths helps to develop the mind and teaches me to think.	64.3	31.4	4.3	**3.79**	0.80	**3.89**
	20. *Maths has <u>not</u> contributed much to the progress of civilization*.	3.0	29.4	67.6	**3.91**	0.88	
	28. *Having good maths skills will <u>not</u> help me get a job when I leave school*.	5.8	14.3	80.0	**4.27**	1.01	**4.38**
Important/Unimportant	6. *Other subjects are more important than maths*.	15.9	50.7	33.3	**3.17**	0.86	**3.13**
	14. Maths we learn at school is important in everyday life.	81.4	15.7	2.9	**4.14**	0.79	**4.13**
	22. Maths is important in maintaining our modern way of life.	72.5	18.8	8.6	**3.88**	0.93	
	30. Having good maths skills is an important part of a well rounded education.	81.4	18.6	0.0	**4.16**	0.71	

Confidence/anxiety	7. *I often get frustrated when doing maths*.	59.4	17.4	23.1	**2.42**	1.19	
	15. *Maths makes me feel nervous and uncomfortable*.	22.9	17.1	60.0	**3.51**	1.13	**3.65**
	23. *Maths makes me feel uneasy and confused*.	26.1	21.7	52.1	**3.30**	1.12	
	31. I don't get upset when trying to work out maths problems.	60.0	21.4	18.6	**3.60**	1.27	**3.70**
Engage/avoid	2. *I plan to do as little maths as possible when I get the choice*.	25.8	21.4	52.8	**3.40**	1.10	**3.42**
	10. *Maths is one of my most dreaded subjects*.	36.2	15.9	47.8	**3.12**	1.31	
	18. Most days I can't wait to start our maths lesson.	4.3	20.3	75.3	**2.01**	0.81	
	26. I usually keep trying with a difficult problem until I have solved it.	52.9	22.9	24.3	**3.30**	1.12	**3.66**

The majority view conveyed by the responses shown in Table 3 is that mathematics is quite a difficult and challenging subject (Easy/Difficult) that invokes mixed perceptions in relation to students' perceptions of their own abilities (Good/bad). Most students did not regard it as their favourite subject but nevertheless almost half professed to enjoy attempting mathematics problems (Like/Dislike). Opinion as to whether or not mathematics is interesting was quite evenly divided with about one third in each of the agree, neutral and disagree categories for these items (Interesting/Uninteresting). Approximately two thirds of the students valued mathematics for its capacity to develop thinking ability and for its contribution to civilization, but even more, approximately 80%, regarded it as necessary and of value in the job market (Useful/Useless). A large majority of students also saw school mathematics as important in everyday life and to a well-rounded education (Important/unimportant). Approximately one quarter of the students responded to each of the Confidence/Anxiety items in a way that indicated a degree of mathematics anxiety, and although slightly more than half indicated that they would persevere with mathematics problems and would continue with the subject when it was no longer compulsory, it was the most dreaded subject for more than one third of the students (Engage/Avoid).

Thomson et al. (2004) reported that Australian 15-year-olds had higher instrumental motivation to study mathematics than the OECD average, and the results presented here in relation to usefulness and importance of mathematics are consistent with that. Comparison with data for the same items from Beswick et al. (2006) suggests that the students in this study may have had more negative attitudes. In particular they appear, on average, to consider mathematics to be more difficult (Items 21 and 29), to see themselves as doing less well at maths (Item 27), to enjoy mathematics less (Items 9 and 17), to find mathematics less interesting (Item 16), and to be less inclined to persevere with a difficult problem (Item 26). Rather than indicating generally more negative attitudes to mathematics in school, the results may simply reflect the decline in attitude with grade level noted by Beswick et al. (2006) from grade 5 to grade 8 and more generally by Boaler and Greeno (2000).

Fifty two students, of the 73 initially invited to participate, completed the questionnaire at the end of the trial. Paired sample *t*-tests were used to compare the attitudes of 49 students who trialed the program and who completed the questionnaire both before and after their use of it. Significant differences were observed for just two items and in both cases the effect sizes, calculated by dividing the difference in means by the standard deviation (Burns, 2000) were small to moderate. Data are shown in Table 4. The lower means following the MathsPOWER trial indicate that students were less likely than before to agree that school mathematics was relevant to everyday life or to be motivated to learn mathematics by

inherent interest in the subject. MathsPOWER presents mathematical content in small, sequential pieces devoid of context. No attempt is made to relate the mathematics to its applications but the rather the focus is on the mastery of knowledge and skills. In view of this it is not surprising that students having used the software were less likely to see mathematics as relevant to everyday life. Apparently this approach also did nothing to inspire students' interest in mathematics for its own sake.

Table 4. Items For Which Significant Change Was Observed After Using Mathspower

	Initial mean (n=49)	Final mean (n=49)	Mean diff. (Initial-final)	Std. Dev.	Sig.(2-tailed)	Effect size
14. Maths we learn at school is important in everyday life	4.102	3.796	0.306	1.004	0.038	0.30
24. My interest in maths means that I want to know as much about it as possible	3.021	2.687	0.333	1.117	0.044	0.30

Given these disappointing results it is interesting to consider the students' responses to the open questions on the second survey about why they did or did not use the program. It seems that many of the students did not engage with it in any meaningful or sustained way. Table 5 shows that most comments were negative but that of these, just two related to the software itself and these were not specific. Similarly, just two favourable comments were about aspects of the program.

Table 5. Responses To Open Questions (N=34)

Reasons for not using/liking MathsPOWER	#	Reasons for using/liking MathsPOWER	#
Lack of time	8	Wanted to see what it was like	1
Computer problems	7	Got bored	1
Can't be bothered	4	Mum made me	1
Don't know	2	To get better	1
Not thought of it	2	Other work too hard	1
Didn't like it	2	Explained without interruptions	1
		Easily explained	1
Total	25	Total	7

The most encouraging finding from the trial involved the use of the program during regular class time with three grade 10 students with learning difficulties. These students were all in the class of the teacher who instigated the trial. One of these students was accommodated with a grade1/2 program and reportedly enjoyed having access to material that was easy to understand at his level. A second responded similarly to a grade 5/6 tutoring program. The third student appreciated the appropriate material but did not enjoy being isolated at a computer away from the rest of the class.

The teacher identified several obstacles to the successful use of program such as MathsPOWER. These included difficulties he experienced getting a networkable version of the program on the school computers and a change in the school's computer arrangements from laboratories to three computers per classroom. This made it impossible to have a whole class working on computers together, and necessarily isolated individual students who used the program in class time. The school also had a policy of no compulsory homework and so work on MathsPOWER could not be mandated as homework or in lieu of other homework demands. Consistent with the finding of Lyons et al. (2006) that parents in rural areas are less likely than those in metropolitan areas to value highly the completion of a university degree, the teacher also cited lack of parental valuing of education.

IMPLICATIONS AND CONCLUSIONS

Conclusions and implications of the study are discussed in relation to each of the research questions in turn.

Research Question 1: What are Rural Year 10 Students' Attitudes to Mathematics?

Consistent with Thomson et al. (2004) and Beswick et al. (2006) the students in this study regarded mathematics as an important and useful subject and particularly so in relation to helping them to find employment. However, there is evidence that suggests that these students had rather more negative attitudes to mathematics than younger students in other rural Tasmanian schools. It is not possible to say whether this difference is due to the a continuation of the trend observed by Beswick et al. towards less positive attitudes with higher grade levels or whether this group of students had more negative attitudes to mathematics than their peers in other similar but rather less remote schools.

The teacher commented on what he perceived to be the poor motivation to learn held by students in the school. In Thomson et al.'s (2004) terms, the attitude questionnaire revealed these students had quite high levels of instrumental motivation to study mathematics. It is possible that this was outweighed by more negative aspects of their attitudes and also influenced by the constrained aspirations for study and work that characterise rural students and their parents (Kilpatrick & Abbott-Chapman, 2002).

Considering the motivation of these students in terms of their needs, wants and means (Hannula, 2006) also suggests low motivation is likely. Hannula (2006) named needs for autonomy, competency and social belonging as likely to be important in educational settings. The MathsPOWER trial met students' need for autonomy in that participation was entirely voluntary and the school's policy of optional homework was also consistent with enhancing students' autonomy. The questionnaire items related to students' perceptions of themselves as good or bad at mathematics suggest that for a sizeable minority of students the need to see themselves as competent was not being met at least in relation to mathematics. Given that poor mathematics self concept is associated with poorer mathematical performance (Thomson et al., 2004) it seems reasonable that this would contribute to lower motivation. Evidence from Lyons et al. (2006) suggests that in rural schools social belonging may also militate against motivation to learn. All of these factors operate in the context of modest wants (aspirations) and limited belief in the availability of means to improve their lot that are common among parents and students in the region (Kilpatrick & Abbott-Chapman, 2002). Together they contribute to a picture of low motivation to learn fed by a range of factors extending from the classroom to school and community levels. In such a context the schools' policy regarding homework seems questionable and is open to (mis) interpretation as evidence of low academic expectations for these students.

Research Question 2: Does Engagement with MathsPOWER Improve Students' Attitudes to Mathematics?

In the context of this study MathsPOWER did not improve students' attitude to mathematics and indeed may have influenced some aspects negatively. Among the factors that

contributed to the lack of success of the program were the students' poor motivation to learn arising from factors discussed in the previous section. In addition, the approach to mathematics teaching employed by MathsPOWER is essentially exposition followed by practice. There is thus a substantial mismatch between the approach to mathematics teaching underpinning the program and that promoted by advocates of teaching for understanding (e.g., Carpenter & Lehrer, 1999; NCTM, 2000).

A further reason for the trial's lack of success relates to the limited role afforded the teacher. Like other Integrated Learning Systems, MathsPOWER was designed for independent student use and hence provided closed tasks that did not invite consideration of alternate approaches and solutions, nor require elaboration or discussion (McRobbie et al., 2000). In contrast to the experience of the majority of students who took the program home, the three students who used the program in regular class time had more positive experiences which are attributable in part to the presence of the teacher and the opportunity therefore available for him to intervene. Although the students involved in this relatively successful aspect of the trial had learning difficulties it should be noted that MathsPOWER is neither a game nor intended for use in a small group settings like the software suggested by Rodd (2006) as having particular potential to motivate such students. Kleiman (2000) commented on the potential of computers to increase student autonomy and therefore motivation by providing individualised learning. However, a program like MathsPOWER that presents a schedule of lessons following an initial diagnosis, limits autonomy to the pace of progress through the tasks, perhaps explaining its apparent failure to motivate the students in this trial.

The school's decision to place a few computers in each classroom rather than concentrating them in laboratories made it impossible to use the program as a whole class and thus militated against the kinds of pedagogies that the teacher might have employed to better engage the class even though the program was designed to work independently of the teacher. Kleiman's (2000) claim, that many teachers lack the pedagogical skills needed to use computers effectively in their teaching, was thus not a factor in this trial.

CONCLUSION

Reasons for the ineffectiveness of MathsPOWER in improving students' attitudes to mathematics are located partly in the design of the program itself and also in characteristics of the school and its wider community. Factors such as parental and community valuing of education including high educational aspirations for students held by parents, teachers and students themselves would be likely to impact on any intervention and are beyond the power of any individual teacher to influence substantially. However, school support in the form of assisting teachers in making students accountable for engaging with material and raising expectations would be helpful and at least a start in terms of positively influencing broader factors. Further research is needed to assess the typicality or otherwise of the attitudes to mathematics of this group of year 10 rural students. It also needed to examine the ways in which factors that militated against the success of this trial, beyond the nature of the particular program, might be effectively influenced.

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NARROWING THE GAP: EMPOWERING TEACHERS AND PARENTS THROUGH UNDERSTANDING HOW CHILDREN WITH DOWN SYNDROME DEVELOP MATHEMATICALLY

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Abstract

Children with Down syndrome (DS) can and do learn mathematics. However, little is known of the process of development. Research evidence is limited largely to number concepts (Bird & Buckley, 2001), and has almost always been collected in large cities. A joint ACU National and SiMERR ACT research study aims to improve the numeracy education outcomes of children with Down syndrome in regional and metropolitan areas by tracking mathematical development of a small group of primary school aged children over one year.

This paper presents the scope of the research and reports results of the pilot stage, which involved developing an appropriate instrument to measure mathematical development. The successful Early Numeracy Interview (Clarke et al, 2002) served as the basis for adaptation.

Piloting the interview identified a number of issues in the development of a useful instrument for the project. Account had to be taken for learning differences (Wishart, 1996) and to determine if the developmental sequence for children with Down syndrome is delayed or different from that of other children. Finally, the modified interview includes areas such as space and time, seeking to redress the lack of research literature in areas other than number.

BACKGROUND

The education of children with Down syndrome (DS) is at an exciting stage in history. Thirty years ago, few children with DS had access to schooling and debate continued as to whether education was possible (Restak, 1975, cited in Rynders & Horrobin, 1990). In 2007, children with DS in Australia are entitled to education in their local school as a right, (HREOC, n.d.). Over these decades, considerable progress has been achieved in understanding learners with Down syndrome. However, with respect to mathematics, much work is still to be undertaken in understanding how children with Down syndrome develop the fundamental concepts of the discipline.

Bird and Buckley (2001), in their review of the literature of mathematics development by people with DS, noted the paucity of research. Almost all of the few existing studies have been related to the Number Strand of mathematics. For example, counting studies have received some attention (Abdelhameed & Porter, 2006; Bashash, Outhred, & Bochner 2003; Caycho, Gunn, and Siegal, 1991; Nye, Fluck, Buckley, 2001) with papers such as Caycho, Gunn & Siegal's arguing that counting development is the same, but delayed when comparing children with DS with their typically developing peers. Use of calculators has also received some attention, although not in recent years, and not specifically with young people with DS (Horton, Lovitt, & White, 1992; Wheeler, Ford, Nietupski, Loomis, & Brownm, 1980). Other areas of the mathematics domain, such as geometry and measurement appear not to have been studied at all for children with Down syndrome, and yet, these areas are critical for the development of lifelong numeracy.

AIMS

In this paper we report the establishment of a research project designed to replicate studies using task-based interviews to gather data on the mathematical development of children with Down syndrome. The research is funded by the ACU National Mathematics and Literacy Education Research Flagship and the Australian Capital Territory hub of the Centre for Science, Information Communication Technology and Mathematics Education in Rural and Regional Australia (SiMERR ACT). SiMERR funding has allowed the research team to address another gap in the Down syndrome literature – all participants in the studies that exist would appear to have lived in metropolitan areas. Living in regional areas is known to be a factor in reduced school performance (Lyons, Cooksey, Panizzon, Parnell, & Pegg, 2006) and may be a factor in the development of children with DS.

The research project described in this paper aims:

- to discover the developmental trajectory of children with DS in early mathematics concepts in the areas of number, space, measurement and mathematical thinking
- to compare the development of mathematical concepts by children with DS with the development exhibited by typically developing children
- to discern strategies for use by teachers and parents to assist children with DS, and
- to investigate if living in a regional area affects the development of mathematics concepts.

Methodology

In order to study the mathematical development of young children with DS, the research team has adopted a mixed mode approach. We will study a small group of primary school aged children over one school year, gathering data that can be analysed using both qualitative and quantitative methodologies.

With such a limited research base, methods to chart the mathematical learning of children with DS are yet to be developed. The choice of task-based interviews was appropriate being a common technique used in most of Australian state-based intervention approaches (Bobis et al., 2005). We have used the Early Numeracy Interview (Clarke et al, 2002) and EMU (Gervasoni, 2004) as the basis of an interview for use in this study. While these instruments are already demonstrably effective, modification, trial and development have been necessary. The initial Early Numeracy Research Project included two special schools and teachers found the interview to be effective in providing a broad range of useful information for children with learning difficulties (though none with Down syndrome) (Clarke & Faragher, 2004).

In adapting the assessment instruments, we needed to be mindful of the need to keep some tasks from published interviews for comparison data. Tasks also needed to be added to observe smaller incremental development, particularly at the introductory stages. In the absence of research literature, it cannot be assumed development of children with DS will follow the trajectory of typically developing children, and so the interview needed to be flexible enough to allow identification of these differences to be observed. Finally, the interview needed to be kept to a length that would not overly tire the participants.

The research study involves three main parts: the pilot phase including the development of the interview, the implementation phase where the main interviews are undertaken and the final phase of data analysis. This paper describes the design of the study and reports the results of the pilot phase and development and use of the interview protocol.

Pilot Study
The pilot study began by trialling the Early Numeracy Interview with a ten-year-old girl with Down syndrome. This interview was video taped and analysed for misinterpretation of questions, problems with task order and difficulties with the materials. The research team met and discussed tasks to include in the interview schedule. Some new tasks were included in the Space section of the interview. This is an area that has not been studied for children with DS and yet there is some indication it may be an area of relative strength (Faragher, 2006). Additional tasks were needed to allow greater discernment of small increments in development. This area of the interview is still undergoing refinement, especially in light of emerging work in the field (Clements, D., personal communication, October, 2007).

The modified version of the interview was then posed to the child involved in the pilot phase. Minor amendments to the phrasing of the questions were made before we were ready for our first interviews with participants in the main part of the study.

Selection of Participants
Twelve children, ranging in age from 6 to 12 years, have been recruited for participation in this study. Seven of these children live in regional areas, including one from a small rural town. These children were nominated by parents who responded to calls for participants placed in newsletters of Down syndrome associations in the ACT, New South Wales and Victoria. Our quota was quickly met in the ACT and NSW, perhaps due to the project research assistant organising the recruitment being well known to parents in both places. We were particularly encouraged at the strong response of families in regional areas. One mother commented that she read Down syndrome research avidly and regretted the lack of opportunities for her son to be involved in studies in the past.

Data Collection
The research involves interviewing each child twice in the year. The interviews are videotaped and parents invited to observe and make notes during the interview for discussion later. At the completion of each interview, parents have been asked to tell us if the children responded as they expected, if questions could be phrased more clearly for their child or to comment on points that may have arisen during the observation. We wished to maximise the possibility of gaining the most trustworthy data we could. In preparation for data analysis, two experienced mathematics teachers have 'transcribed' the videos by recording the question asked and the response of the child. In many cases the responses were non-verbal and the transcriptions have included notes about the behaviour of the child. These transcriptions have been entered on a spreadsheet to allow tracking of trends in development between and among the children in the study.

THE INTERVIEW
In this section of the paper, we describe the interview protocol and our experiences with the first round.

The Interview Protocol
As for the Early Numeracy Interview and EMU, the interview involves asking children to perform tasks with objects. For example, we put a collection of plastic teddy counters on the table and ask the participant to put all the yellow teddies together and then to count them. In another task, we ask them to put one straw in each cup, having put five plastic cups on the table. The equipment is put in a variety of interesting boxes and containers to encourage curiosity in the tasks. The modified interview contains the following main sections:

Section A – Counting
Tasks in the first section involve counting small collections and the concepts of 'more', 'less', conservation, subitising, and one-to-one correspondence. Other tasks involve matching numerals to quantities; ordering numerals (0-9); and using ten-frames.

Section B – Counting without Objects
Tasks in this section cover rote counting; counting forwards, backwards and from different starting points; stating the number before and after a given number; counting on a hundreds chart; and counting by 10s, 5s and 2s.

Section C – Place VIue
Place value tasks involve reading numerals up to four digits; writing numbers on a calculator; being able to read numbers on a calculator display; and ordering collections of 2-, 3- or 4-digit numbers. These tasks are followed by tasks which ask the children to use bundling sticks: one to make a given number, the other to write the number for a set of bundling sticks. Finally, the children are asked to identify a number covered on a hundreds chart.

Section D – Addition and Subtraction Strategies
This section offers opportunities to demonstrate 'counting-on' strategies; addition with symbols; use of a number-line to add or subtract; and mental computation.

Section E – Multiplication and Division Strategies
In offering the children tasks to show multiplication, we are also able to gather data on whether the children are able to share objects evenly, for example by putting two teddy counters in each matchbox.

Section F – Measurement (Time)
At the start of the interview, the children are invited to draw a clock on a piece of paper. This drawing is discussed at the start of this section of the interview to find out the child's understanding of the arrangement of the numbers, the purpose of the hands and what a clock is used for. A real clock is then used to ask children to read times. Tasks in this section also include naming days and months; before and after questions for days and months and finally being able to read and interpret a calendar.

Section G – Space
The final section of the interview is under development but for the first round of interviews included location tasks (vocabulary such as 'beside', 'behind'); describing the location of a playground; shape sorting tasks (looking for classification according to properties); being able to identify shapes in the environment, especially in different orientations; and recognition of similarity and difference for related shapes.

Interviewing the Children
In making decisions about the staging of the interviews, we were mindful of research that demonstrated the diminished performance of children where they were interviewed in clinical settings by researchers they did not know (Brown & Semple, 1970). Therefore, children were interviewed in a familiar setting in the presence of their parent. On one occasion, a teacher observed as well; and in another, a teacher aide was present. Most participants were interviewed in their home, though some parents arranged the interviews to be at the child's school and some interviews were conducted in a university office. This seemed not to disturb those participants. Following one interview, the mother attended the university open day to report how proud her son was to be involved in a university project, telling friends that this was 'his university'.

The children were invited to choose a pseudonym for use during the project so we have Shrek, Cinderella, BJ and Hun involved. Most, though, preferred their own name and that is what we have used with the consent of their parents and in agreement with the approved ethics protocol.

Time was spent at the start of the interview chatting to the parent and the child. Offering the child paper to draw a clock (needed for later in the interview) allowed the child time to settle and experience early success. It also allowed the interviewer the opportunity to become accustomed to the style of communication of the child. Some of the children appeared nervous at the start, although most were clearly excited.

We were astonished at the variety of approaches the children took to the interview. The behaviour of the children ranged from confident performance (even described by one mother as 'showing off') to shy whispering. One of our younger participants found it all too much and needed considerable encouragement from his mother to continue the interview. The most surprising was Travis, one of our older students. At the start of the interview, he was very reluctant to participate. He refused to answer any questions, though was engaging when the interviewer was chatting and asking about non-mathematics topics. As soon as task questions were posed, he folded his arms and looked away. As participation in this research is voluntary, he was offered the opportunity to withdraw, however, he agreed to continue. For some time, particularly with the early counting tasks, he gave the impression he was unable to count. The interviewer used techniques such as pretending to make mistakes with counting to observe if he noticed. As he did, it was obvious he was able to perform the task – he just did not want to show that he could. Similar behaviour has been observed by Wishart (1996). Having carers present who can tell us if their child is under-performing as well as providing opportunities in the interview to approach a concept from alternative tasks are strategies we have deliberately employed to enhance the likelihood of our gaining data we can trust.

For many of the children, the interviewer made use of a sticker chart to encourage and reward participation. Interviews lasted between thirty and sixty minutes and most of the children were engaged through that time. The stickers assisted to maintain their interest. In two interviews, notably Travis', the stickers served as a supplementary counting task.

Following completion of the interview, the children were invited to select a small gift to thank them for their participation. We then allowed time to talk to the carers present, discussing notes made during the interview and talking more about the purpose of the research. Many parents expressed keen interest in our opinion of how their child had performed.

FUTURE PLANS

We have completed the first round of interviews and commenced the initial analysis of the data. It is exciting to see the study unfolding. There is an enormous amount of data resulting from the video taped interviews and conversations with parents to be analysed. The first stage of the process is underway with the transcription of the videos. These are being entered on a spreadsheet which allows comparison of responses across all the interviews. Furthermore, tasks that are common to the Early Numeracy Interview allow comparison with the more than 35 000 responses from Victorian school children. Following the second round of interviews, we anticipate being able to identify development of individual children and perhaps observe common patterns across the children. This, too, may be able to be compared to the pattern of growth of the typically developing children.

The transcripts allow some quantitative analysis of the data, however, a considerable amount of data is lost in the spreadsheet record. Fortunately, the small sample allows us to study individual cases in detail. As a team, we have begun qualitative analysis of the data, closely watching excerpts of the interviews.

The second round of interviews will add to the data we have already gathered on the number strand. Sections F and G of the interview deal with other strands and offer some of the first data available for children with DS. In order to make this data more robust, we are continuing to develop these sections of the interview. We expect the second round of interviews will provide more detailed information than we have at present. We hope to continue to work with the study participants to track the geometry development beyond the first year of this project.

As the title of this paper suggests, our main purpose in this research is to empower teachers and parents through the understanding we hope to gain about the mathematical development of children with Down syndrome. Only through research can those closely involved in the teaching and learning process be advised of best practice approaches. In the 1960s life expectancy for people with Down syndrome was around 15 years. Now, it is more than 50 with one in ten living to their seventies (Brown, 1996). Preparation for a long adulthood is essential and begins in the early years. Foundation concepts of mathematics underpin lifelong numeracy development, an important goal for all learners, including those with Down syndrome.

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NARROWING THE GAP IN THE REGULAR CLASSROOM : SUCCESSFUL STRATEGIES FOR TEACHING AND LEARNING IN THE MIDDLE-SCHOOL YEARS

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Abstract

This paper focuses on the educational disadvantage experienced by middle years' students with learning difficulties. It has a specific focus on those students living in regional, rural and remote areas of Australia. Students in the middle school years who experience challenges with learning are repeatedly disadvantaged, yet the planned efforts of a reflective, well-informed teacher can make a great contribution to overcoming obstacles to successful learning encountered by these vulnerable students. The paper begins with a review of the concept of learning difficulties in a contemporary context and then goes on to identify obstacles to effective learning commonly experienced by middle years' students with learning difficulties. After a brief examination of these issues in the context of regional, rural and remote areas of Australia, the information is then synthesised into proactive frameworks for teachers, which link the factors of disadvantage with strategies for overcoming or 'working around' these cognitive obstacles. Based on the understanding that teachers have great potential for 'narrowing the gap' in performance and participation of students with learning difficulties, the frameworks describe evidence-based adjustments to teaching and learning in literacy, basic mathematics and content area learning, that can be readily implemented in a range of teaching and learning contexts.

INTRODUCTION

Students with learning difficulties are known to face considerable challenges during their middle school years. Poor achievement levels, lack of engagement with teaching and learning and poor participation rates in post-compulsory education are common indicators that, for older students with learning difficulties, schooling is challenging, unrewarding and at times, fails to meet their learning and affective needs.

Whilst younger students with learning difficulties justifiably attract a large proportion of research and support services, and students in the final stages of schooling can access various vocational and non-academic options, students in the middle-school years (years of schooling 6 to 9) with learning difficulties appear to be an under-served group that has not been a high priority in educational systems to date (Luke et. al, 2003)

Students in the middle school-years with learning difficulties living in regional, rural or remote locations are further disadvantaged because of restricted access to professional services including educational, therapeutic and medical support services. In such restricted circumstances, professional responsibility for providing equitable access to education and life opportunities for students with learning difficulties and additional needs defaults, almost entirely, to the classroom teacher, especially after the first few years of schooling.

Middle-school teachers want to address a perceived lack of engagement in learning among students, to improve their attitudes to learning and to ensure that all students experience success & enjoyment in learning (Cuttance, 2001). However, at times teachers are bewildered by the wide range of learning needs in their classrooms and concerned about their own levels of professional knowledge to assist them to cater for students with special education needs (Westwood & Graham, 2003).

This paper responds to these concerns by promoting the theme 'Power to the Teacher', based on the understanding that classroom teachers have the potential to narrow the gap in student under-achievement and to positively impact on student learning and affective outcomes. Whilst this may at first seem a somewhat glib statement, the implications are potentially empowering – regardless of student and environmental factors, classroom instructional processes are a major variable influencing on student achievement. This is particularly the case for student with learning difficulties (Hattie, 2005; Mastropieri, & Scruggs, 2002; Sanders & Rivers, 1996; Schacter & Thum, 2004).

The impact of poverty, disadvantage and deprivation on the learning achievements of students is implicitly understood by many teachers. Whilst these issues are crucial factors which undoubtedly impact on student achievement levels, they are not factors that teachers can readily influence. So, what can teachers do when faced with limited access to support services and increasing numbers of students with additional needs? Teachers can teach! Informed, reflective classroom teachers can and do make a difference to the learning outcomes and experiences of their students.

Effective classroom teachers use instructional strategies and approaches that better enable students with learning difficulties to 'work around' or even overcome the obstacles to learning they so frequently experience. This paper attempts to support this process by presenting background knowledge about learning difficulties and some of the cognitive and affective factors that impinge on student learning, in contemporary Australian classrooms during the middle school years. Also, in keeping with the regional, rural and remote theme of the conference, selected findings from two recent reports, commissioned by the Federal Department of Education, Science and Training, regarding education in regional, rural and remote Australia will be briefly reviewed and discussed in terms of their relevance to teaching, learning and learning difficulties. The final section of the paper refers to research about effective teaching approaches and strategies and presents tables containing effective teaching strategies that teachers can readily implement in inclusive classrooms for middle years' students.

STUDENTS WITH LEARNING DIFFICULTIES IN THE MIDDLE SCHOOL YEARS

There continues to be debate in the literature about learning difficulties, particularly regarding the discrepancy between a student's learning potential and level of achievement (e.g. Fuchs & Fuchs, 1998; Scott, 2004). Making the issue more complex is the profusion of terms used around this concept – learning difficulties, learning disabilities, learning delays, dyslexia, ADD/ADHD etc. In Australia, there is no operational definition of learning difficulty nationally and there is considerable overlap in the use of the terms 'learning difficulty' and 'learning disability' (Scott, 2004).

The percentage of students identified with learning disabilities or difficulties continues to increase. Currently, about 7% of the school-age population in North America is considered to have some form of learning disability (Gersten, Fuchs, Williams & Baker, 2001). In Australia, where the definition of learning difficulties is broader and includes students with various learning difficulties, at least 20% of school students are considered to have problems in academic areas and of these students 5% are considered to have specific learning difficulties (Westwood & Graham, 2000).

In Australian schools the term "learning difficulties" is usually applied to students based on their classroom performance and results obtained from school-based assessments or state mandated academic skills tests. Educators and researchers generally make a definitional distinction between students with a diagnosed disability and those with a learning difficulty, although the validity of this distinction has been questioned (Scott, 2004). In Australia, students with learning difficulties that are not related to any disability or condition are the largest single group of students with special educational needs (Westwood, 2003).

Inefficient Cognitive Processing

Students with learning difficulties in the middle-school years frequently display certain cognitive characteristics that impede learning. Generally, for example, students with LD are very inefficient in their approaches to learning. Such inefficiencies relate to cognitive procedures such as using inappropriate or inefficient strategies that are slow and produce high error rates, having difficulty recalling previously encountered knowledge, and flexibly using accumulated knowledge (Doyle, 1983; Westwood, 1993a). Thus, in the classroom LD students often use lower-order strategies, such as counting on fingers to work out number facts or using sounds to decode previously encountered words, because they use inefficient cognitive habits, or non-strategic ways of thinking.

The processes and functioning of working memory have been identified as key underlying factors in all learning difficulties (Keeler & Swanson, 2001). Working memory has been described as the "mental workbench" (Borich & Tombari, 1997) where immediate and short-term cognitive operations take place. An essential characteristic for learning is that working memory functions by simultaneously storing and processing information (Ashbaker & Swanson 1996).

Students with LD not only experience inefficiencies within and between the components of working memory, but also in terms of their working memory capacity (the amount of information they can hold 'in mind') which is thought to be less than that of their non-LD peers under particular conditions (Swanson & Siegel, 2001; Swanson, 2000). These limitations in working memory functions or processes, which are often closely related to deficiencies in executive processes such as memory and attention, pose significant obstacles to successful learning for students with learning difficulties.

Lack of Automaticity in Basic Academic Skills

On entering the middle school years many students with LD will have developing understandings about basic academic concepts and procedures, yet many of these students get 'stuck' and are unable to apply or develop this knowledge with ease because of their poor literacy and numeracy skills. This lack of automaticity in basic skills such as reading and calculating can be readily observed and is commonly seen by teachers as the essence of learning difficulties.

Automaticity in basic academic skills was initially thought to occur when almost no cognitive resources were used (Anderson, 1980; La Berge and Samuels, 1974) to recall well-known facts or use practiced procedures but more recently researchers have linked automaticity to extremely efficient cognitive processing (Perfetti, 1988; Stanovich, 1990). From this perspective the most important feature of automaticity is not that it enables fast recall but rather, that it reflects increasingly efficient and effective cognitive processing (Perfetti, 1992). Automaticity in basic information retrieval is of prime importance because it allows for small decreases in time to accrue in undertaking sub-tasks which frees up cognitive resources (working memory, attention, etc) to focus on other aspects of the task.

'Expert' learners have highly automatised component sub-skills while 'novice' learners, in this case, students with learning difficulties, need to work effortfully on the component skills they have encountered many times before (Stanovich, 1990). In this way, limited automaticity in basic academic skills further depletes constrained working memory resources and frequently precludes students with learning difficulties from engaging in higher-order or procedural aspects of a task.

Affective Factors

Experiencing persistent learning difficulties can have serious, negative impacts on students' emotional well-being and can have detrimental effects on social interactions (Fuller, 2002; Vaughn & Hogan, 1990). Students with learning difficulties have an increased likelihood of displaying inappropriate social skills and tend to be less popular with their peers than non-LD students (Elbaum & Vaughn, 2003; Vaughn, Hogan, Kouzekanani & Shapiro, 1990). Poor social competence is often a confounding factor that adversely affects on school experience and constitutes another obstacle to successful learning for many students with learning difficulties.

Self-esteem, defined as the value one puts on one's self and behaviour, is almost entirely created by an individual's experience of success and failure (Seligman et.al, 1995). Accordingly, the low self-esteem displayed by some students with learning difficulties is not usually the cause of learning or behaviour problems, but develops as the result of repeated lack of success (Westwood, 2004).

The feeling of powerlessness that may lead students with learning difficulties to believe that they are unable to succeed has been termed "learned helplessness" (Diener & Dweck**,** 1978). Learned helpless behaviour has a highly debilitating effect on academic performance. Specifically, if students perceive that they cannot possibly achieve success because of factors beyond their control, then their levels of participation, engagement and performance on any task will decrease.

Learned helplessness and low self-efficacy can result in the following affective characteristics, displayed during the middle school years by many students with learning difficulties: reduced motivation, lack of persistence in the face of failure, negative expectations about the future, a tendency not to develop a strategic approach to learning, avoidance strategies and a generally negative affect (Weiner, 1992; Westwood, 2004).

Clearly, experiencing persistent learning difficulties presents students with many obstacles to successful learning. Cognitive processing constraints, poor skill level in basic tasks and negative self-perceptions are major influences on the school success of students with learning difficulties. The additional complexities of these issues for regional, rural and remote middle years students with learning difficulties and their teachers will be briefly reviewed in the next section.

RURAL AND REGIONAL PERSPECTIVES

At the Narrowing the Gap conference held in rural NSW it is particularly relevant to consider issues of teacher work and student diversity in rural, regional and remote Australia. In doing so, two reports recently released by the Commonwealth Department of Education Science and Training (DEST) will be selectively reviewed. Both reports are quite extensive and cannot be justly represented here. However, some of the findings are very relevant to this discussion. Importantly, in both reports, students with learning difficulties in regional, rural and remote communities were identified as a significantly disadvantaged group.

Impact of Drought Report

The first report, 'The impact of drought on secondary education access in Australia's rural and remote areas' (Alston & Kent, 2006), was compiled by researchers from the Centre for Social Research at Charles Sturt University. These researchers describe children living in drought affected rural or remote Australia as 'silent victims' whose access to a good education is compromised. The drought has led to an increase in debt, resulting in decreased opportunities for children and their families, an increase in poverty and flow-on effects such as increased school drop-outs and more frequent translocation.

The impacts of the drought on education are frequently related to the accelerated rate of rural restructuring identified in the report. Rural restructuring results in, for example, farms amalgamating and the consequent loss of families and young people from regional, rural and remote areas. An ensuing effect is a decrease in school numbers which has a negative impact on the availability of education and affiliated services in the community. The closure of small schools and the down-turn in student numbers impacts on teacher numbers, subject offerings and teacher professional development opportunities.

The report noted that the drought has particular, harmful impacts on students from specific groups. As a result of the drought, Indigenous students experience even more limited access to literacy and numeracy classes and increased problems with absenteeism. Students with 'special needs' are noted to be especially disadvantaged when they live in remote areas away form services and support. As the report noted, key action is required to provide additional supports for Indigenous students and students with special needs living in drought affected areas so they can have equitable access to educational options.

SiMERR National Survey

The second report is 'The SiMERR National Survey' (Lyons et. al) which provides a much needed focus on teacher perspectives about teacher needs in regional, rural and remote parts of Australia. This report was compiled by researchers affiliated with the National Centre of Science, Information and Communication Technology and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England.

Teachers in regional, rural and remote areas, specifically teachers of Mathematics, Science and ICT, are challenged by factors such as high annual staff turn-over rates and by having to teach in subject areas in which they are not qualified. The teachers were keenly aware that, relative to students in metropolitan and major regional areas, their students could only access a limited range of options for learning experiences. The participating teachers identified a significant unmet need to provide alternative activities for specific groups of students, including Indigenous students and students with learning difficulties.

The report highlighted two key challenges identified by teachers in regional, rural and remote areas which pertain to inequities in resourcing and in accessing professional development. Teachers in regional and remote areas of Australia indicated a high level of unmet need in terms of adequate resourcing to develop appropriate learning support programs that encompass student diversity, accompanied by the further unmet need for professional development to cater for the needs of Indigenous and special needs students.

Although this is a selective review of the findings of both reports, the information presented here does clearly indicate that meeting the additional learning needs of students with learning difficulties and Indigenous students is an issue of great concern for teachers as well as an area of perceived inequity. The paucity of additional professional services available in regional, rural and remote Australia is not just an issue for students with learning difficulties and their families but also for teachers who are limited in their access to information, appropriate resources and professional development opportunities. Although this situation is challenging and demanding for the students and their teachers, it is not hopeless or unalterable because of the power of effective teaching to positively impact on student learning outcomes. The following section will provide information about specific strategies and approaches to support this process.

'POWER TO THE TEACHER' FRAMEWORKS

Effective teaching for students with learning difficulties generally does not require new or specific instructional strategies but rather relies on what many practitioners would call "just good teaching" or what Westwood (1993b, p.92) calls "the tried and true basics of skilled teaching". Research has shown that instructional strategies that enhance learning outcomes for students with LD result in improved outcomes for ALL students (see Vaughn, Gersten & Chard, 2000). The 'Power to the Teacher' theme rests on the understanding that effective teaching is concerned with things teachers do to increase student participation and learning (see Mastropieri & Scruggs, 2002; Rosenshine, 1997). Effective teaching necessitates a focus on teacher actions and decision making. Westwood (1993a) defined effective teaching as the clear teaching of important skills, information and appropriate strategies.

Strategies for Addressing Cognitive Factors of Learning Difficulties

Effective teaching for students with learning difficulties requires explicit teaching and strategy instruction. In an influential meta-analysis of reading interventions (word reading and reading comprehension), Swanson (2000) highlighted that a combined instructional model that includes components of strategy instruction and direct instruction yielded a very substantial effect size for reading comprehension. For word reading, a direct instruction approach also exceeded criteria for a substantial effect size. There is also considerable evidence in the literature to support the claim that direct instruction is an effective approach for students with learning difficulties in mathematics (e.g. Baker, Gersten & Lee, 2002; Kroesbergen & Van Luit, 2003) Further, evidence is emerging, in both reading and mathematics learning difficulties research, that student-centered or discovery-learning instructional approaches are not particularly effective for improving learning outcomes for students with learning difficulties (see Baker, Gersten & Lee, 2002; Ellis, 2005; Rowe, 2006). Explicit instruction is especially necessary when teaching new or difficult information and when content is critical to subsequent learning (Mercer, Jordan & Miller, 1996).

In a more fine-grained analysis, Swanson and Hoskyn (2001) used measures of effect size to identify instructional components that best predict positive outcomes for adolescents with learning disabilities. Effect-size is an index that measures the magnitude of a treatment effect, independent of sample size. The researchers' results identified advanced organisers (i.e., statements or strategies that direct students to preview instructional material and provide information about the learning task) and explicit review and practice as the most important instructional components related to high effect sizes in intervention studies designed to improve the academic performance of students with learning disabilities. Specifically, review and practice encourages the development of a reliable knowledge base that can be efficiently accessed, and the use of advanced organizers provides students with a mental scaffold of the targeted learning content. In Figure 1 these instructional components are listed, along with others, as strategies teachers can implement to support middle years' students experiencing constraints in cognitive processing that impact on the acquisition and retention of knowledge.

Table 1. **'Power to the Teacher' Framework for Addressing Cognitive Factors of Learning Difficulties**

Strategies For Addressing Cognitive Factors Of Learning Difficulties	
Obstacle: Cognitive Factors	**Effective Teaching Strategy (adjustment)**
Inappropriate or inefficient use of strategies	• Model efficient strategies in a supportive environment • Use teacher and peer 'think-alouds' • Teach by showing, demonstrating, peer modelling • Encourage reflection & talk about learning processes
Difficulty recalling previously encountered knowledge	• Provide explicit, repeated review & practice • Begin every lesson with review of prior content • Make strong connections with prior knowledge and current interests • Use mnemonics and other memory aids • Provide visual cues and supports to aide retention and recall
Limitations in working memory	• Teach cognitive strategies & procedures (repeatedly) • Use advanced organisers (preview and pre-teach) • Chunk (break up) content and tasks into achievable steps • Use graphic organizers (search the web for lots of samples of graphic organizers) • Provide scaffolds & proformas e.g. writing proformas for text types and subject-specific reports, scaffolds for assignment responses

Strategies for Addressing Difficulties with Reading, Writing and Basic Mathematics

Effective, explicit teaching involves showing, telling, using think-aloud protocols and self talk, as well as modeling and demonstrating by both teacher and peers so that a systematic and structured approach to instruction leads students toward mastery and success. Providing regular opportunities to practice and revise previous work is especially important in the acquisition and development of basic academic skills. Other strategies for classroom teachers to implement in word reading, comprehension, writing and basic mathematics skills are presented in Figure 2 and Figure 3. It is important to note that these strategies are relevant for content area learning in all subjects, not just English and Mathematics.

Table 2. **'Power to the Teacher' Framework for Addressing Limited Proficiency in Basic Literacy Skills.**

Strategies For Addressing Difficulties With Reading & Writing	
Obstacle: Limited Proficiency in Basic Literacy Skills	**Effective Teaching Strategy (adjustment)**
Poor word reading Lack of automaticity	• Provide frequent review and revision of basic words (common words and sight words). Practice these to the point of 'over-learning' • Pre-teach and frequently practice relevant vocabulary for every new content area • Display key words with a picture cue • Explicitly teach decoding strategies such as breaking words into parts e.g. onset & rime or syllables, sounding out parts of words, seeing small words or blends in big words, thinking of similar looking words, • Develop students' knowledge of parts of words: prefixes, suffixes, vowel blends (use word families) • Practice using repeated reading of familiar texts – focus on fluency • Use the Neurological impress method (NIM) • Provide peer reading, guided reading, readers' theatre
Difficulties with reading comprehension	• Preview content before reading to set context and to help activate background knowledge • Make predictions prior to reading • Use a highlighter to mark out important parts of the passage, unknown words, parts where meaning is unclear etc • Slow down pace of reading so focus can shift to meaning • Construct an overview of the text • Fill in a graphic organizer after reading • Teach question-answer strategies such as 3H strategy
Limited writing skills Reluctance to write	• Use scaffolds / outlines • Provide advanced organisers, e.g. concept maps, essay planners • Promote & model use of computer programs such as 'Kidspiration' & 'SparkSpace' to organize ideas; 'Read and Write Gold' & 'Co-Writer' featuring predictive text and spelling support • Provide display charts and 'reference sheets' showing key word spelling and content specific vocabulary • Practice writing fluency (timed activities and personal bests), encourage quantity as well as quality • Encourage students to develop keyboard skills

Table 3. **'Power to the Teacher' Framework for Addressing Limited Proficiency in Basic Numeracy Skills.**

Strategies For Addressing Difficulties With Basic Mathematics	
Obstacle: Limited Proficiency in Basic Numeracy Skills	**Effective Teaching Strategy (adjustment)**
Poor basic mathematics skills	• Provide opportunities for frequent review and practice of basic facts • Teach and practice similar facts together (+/- and x ÷) • Maintain the focus on practice activities over an extended period of time • Use timed practice activities so students can beat their 'personal best' times • Give preference to frequent, intense, short bursts of practice • Use a variety of practice approaches, e.g. flashcards, speed-sheets, games, repeated & timed practice on appropriate worksheets, peer activities etc. • Teach (repeatedly) & display counting and grouping strategies • Relate basic math facts to basic living skills – money, measurement, card-games, cooking etc.
Limited competence and confidence in mathematics problem solving	• Teach a 'step-by-step' approach, e.g: Identify the problem Draw the scenario Select a strategy to solve the problem Put the information into an algorithm Calculate Evaluate • Teacher & peer modelling, followed by guided & independent practice • Explicitly teach strategies such as: Use models, number lines or concrete materials Look for key words Make a drawing or diagram Act it out / visualise Remove irrelevant detail Construct a table or graph • Pre-teach and frequently practice key words for each new Mathematics topic as well as generic math prefixes and suffixes e.g. deci-, centi-, milli-, -meter, -gram, pent- etc.

Strategies for Supporting Social & Affective Aspects of Learning.
Improving students' academic skills can led to significant gains in academic self-concept, self esteem and self-efficacy (Vaughn, Gersten & Chard, 2000; Westwood, 2004). Therefore, it is important for teachers to take every opportunity to "break the cycle of failure" by providing students with experiences and tasks at which they can be successful. Accordingly, regulating the level of task difficulty, that is, providing work at an appropriate level for the student, is one of the most significant adjustments to instruction that teachers can make. Identifying and discussing the reasons that students use to explain their success or failure (their attributions), may also help students identify maladaptive attribution patterns and encourage them to take greater responsibility for their own learning. Other strategies that can support students to overcome affective obstacles to learning and participation are listed in Figure 4.

Table 4. **'Power to the Teacher' Framework for Addressing Affective Factors of Learning Difficulties**

Strategies For Supporting Social & Affective Aspects Of Learning	
Obstacle: Affective Factors	**Effective Teaching Strategy (adjustment)**
Poor social competence	• Carefully planned co-operative learning activities • Consideration re seating / placement • Use careful groupings to facilitate good peer modeling • Tell students about the structure of the lesson, e.g. "First we are doing…….. then….." • Classroom rules clearly displayed, regularly referred to and consistently and fairly enforced • Consequences for non-compliance need to be known in advance and (where possible) logical to the offence
Poor academic self-concept / low self-esteem	• Adjust the level of task difficulty, ensure the work is at an appropriate level for the student's capabilities & skills • Avoid failure situations, e.g. asking students to answer questions unexpectedly, reading aloud without prior warning, assignments & assessments without adjustments • Reward effort more than achievement • Measure progress against previous achievement (where possible) rather than standards-referenced benchmarks
Poor self-efficacy & learned helplessness	• Student reflection about learning, examine attributions • Teacher feedback to students - focus on strategies used, persistence and effort • Encourage realistic pre-task expectations of performance • Model & use 'think-alouds' from other students to show a range of attributions regarding why individual were able to succeed at a task

CONCLUSION

In many instances, students with persistent learning difficulties in the middle school years are unlikely to 'catch up' with their average-achieving peers without appropriate support services and specific, longer term academic skills interventions. The teachers of these students also require access to specialist teacher support and professional development to enable them to better meet their students' needs. There is certainly more to be done at the policy and program levels to deliver equitable educational outcomes for middle years' students with learning difficulties. This is especially true for those living in regional, rural and remote parts of Australia.

However, there is much that classroom teachers can do to improve participation in learning and consequently increase the learning and living opportunities available to vulnerable young Australians. Effective teaching, using explicit instruction, strategy instruction and other research-based instructional strategies, is a powerful paedagogical approach. The frameworks presented in this paper specify teaching approaches and strategies that are available to most classroom teachers as they generally do not require particular programs or resources. The frameworks also provide a guide for teachers and education administrators regarding sound educational approaches for middle years' students with experiencing persistent learning difficulties. This information has the potential to 'narrow the gap' in student achievement levels and to reduce the educational disadvantage currently experienced by a significant minority of middle years' students in Australian schools. Teachers can teach – power to the teachers!

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ADAPTIVE HELP-SEEKING AS A MEANS OF NARROWING THE GAP FOR STUDENTS WITH DISABILITIES: A PILOT STUDY

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Abstract

This study explored the adaptive help-seeking strategies of three junior high school students with intellectual disabilities in inclusive classes. A consistent finding of research in help-seeking has been that students who most need help are least likely to seek it. By extension, students with disabilities in inclusive classrooms are less likely to use effective learning strategies and are consequently more dependant on assistance from the teacher and from peers. Using non-participant observation and semi-structured interviews with teachers and students the study revealed that in inclusive classrooms students with disabilities rely heavily on their peers. It is not clear, however, whether in this context students are developing the strategies of efficient, self-regulated learners.

INTRODUCTION

This paper is concerned with one aspect of the instructional gap which students with disabilities experience in the regular classroom the use of adaptive help-seeking strategies. It will be argued that poor or ineffective help-seeking strategies is a feature of many students with disabilities, but that the development of those strategies may also be a means by which academic disadvantage in the regular classroom may be overcome. A difference in the adaptive help-seeking strategies of students with and without disabilities may, therefore, be both an explanation of an instructional gap but also a potential means of narrowing that gap.

CONTEXT OF THE STUDY

It is the case across the Western world that the education of high school-aged students with mild intellectual disabilities is increasingly occurring in regular high school classes. Whereas educational services for this population used to take place in specialised settings, such as support classes, there is an increasing number of students with mild intellectual disabilities who are full-time permanent members of regular classes. This is not to say, however, that there are no special provisions made for these students. A range of special provisions and adjustments are made by education systems including adjustments to curriculum, reporting and credentialing, instruction, and the provision of support personnel. Commonly, students with mild intellectual disabilities in regular high school classrooms are supported, at least for some of the time, by teachers' aides. In NSW government schools these teachers aides are responsible to the school principal for providing assistance in school routines, classroom activities and the care and management of students with disabilities and behaviour disorders (DET, n.d.). Despite these special provisions and adjustments, however, gaps usually exist between the outcomes of students with mild intellectual disabilities and those of peers.

Instruction in schools takes place in a context where students are expected, as they make transitions from primary through secondary grades, to take increasing control of their own learning. A goal of the NSW Government, for example, is to develop "a society in which individuals with disabilities and their carers live as full citizens with optimum quality of life, independence and participation" (NSW Government Disability Policy Framework, 1998). An excerpt from a recent policy document in Queensland is typical of these policy documents in its expectation that students will not be passive recipients of learning but, instead, be active and increasingly self-reliant citizens who make positive contributions to society.

> "Over the next decade, the central purpose of schooling in Queensland should be to create a safe, tolerant and disciplined environment within which young people prepare to be active and reflective Australian citizens with a disposition to lifelong learning. They will be able to participate in and shape community, economic and political life in Queensland and the nation. They will be able to engage confidently with other cultures at home and abroad." (Queensland State Education 2010: A Future Strategy, 2000).

In this context it is a responsibility of education systems to develop students' ability to take responsibility for their own learning, rather than for those students to develop passive and dependent approaches to learning. For some teachers in regular high school classes, however, the inclusion of students with mild intellectual disabilities can create some uncertainty. While these teachers may have generally positive attitudes to inclusion, they may be less than confident in their ability to implement instructional approaches to support these students. Instead, teachers have indicated a preference to have students with disabilities supported in the classroom by teachers aides or other support personnel (Idol, 2006). Other research (Takala, 2007) has indicated that in regular classrooms, these teachers aides are more likely to work directly with students than in specialist and that a key to effective use of support personnel is clarification of classroom roles (Moran & Abbott, 2002).

In summary, students with intellectual disabilities who are included in regular classrooms are usually taught by teachers who have positive attitudes to inclusion but who lack confidence in their own ability to meet student needs. Teachers' aides are seen as having an important role in the inclusive classroom although availability of those teachers' aides to support students with intellectual disabilities in Australian schools is usually dependent on limited funding sources and teachers' aides for these students are rarely available for entire school days.

With regard to the development of self-regulatory skills of students, both teachers and teachers' aides have a responsibility to support student learning in such a way that those students do not become dependent on the assistance provided. While teachers in inclusive classrooms generally welcome the presence of support personnel such as teachers' aides there is, however, the potential for benefits offered by the provision of such support to be negated by the development of dependence by students on those provisions. Instructional approaches which reduce student dependence on support provisions and which reflect the broader goals of education are those which should be the focus of all educators.

ADAPTIVE HELP-SEEKING

A cognitive and metacognitive approach to instruction is one which focuses on the internal strategies which individuals use to learn. Typically, this approach involves teaching students how to be aware of cognitive strategies and how to regulate those strategies (Flavell, 1979). Over a number of years, this instructional approach has been successfully used in a number of domains including social skills development, memory and comprehension. A feature of a cognitive and metacognitive approach is that students are equipped with the strategies that they need to engage with a range of learning situations; taught how to use them and taught to recognise the conditions under which those strategies might effectively be employed (Paris & Byrnes, 1989). An approach to instruction such as this is particularly helpful in regard to the overall goals of education as described above since it focuses on the development of an individual's personal learning skills, skills which they would take beyond the context of formal school learning.

There has since the time of Flavell been a considerable amount of research conducted on cognitive and metacognitive strategy instruction. In non-educational domains such as psychology, psychiatry and mental health there has been for some years an interest in a

particular set of strategies, those related to help-seeking. These studies have explored issues such as aspects of individuals who seek help for a range of psychological and psychiatric issues, roles of social networks and the efficacy of the interactions with helpers (Gourash, 1978).

Interest in help-seeking as it relates to instruction began with the work of Sharon Nelson-Le Gall (Nelson-Le Gall, 1981)and this body of research has been an important contributor to research in the more general study of cognitive and metacognitive instruction (Le Mare & Sohbat, 2002; Newman, 2002; Newman & Schwager, 1993; Ryan & Pintrich, 1998). Adaptive help-seeking has been defined as 'asking for the help needed in order to learn independently, not simply to obtain the correct answer' (Nelson-Le Gall, 1981; Newman, 1998). It is a strategy or cluster of strategies employed by self-regulated learners but differing from many other learning strategies in that it requires interaction with others. There are, therefore, both social and cognitive components to adaptive help-seeking.

This research has been carried out in several fields, educational and non-educational. Of particular interest to researchers in the flied of counselling and mental health has been the help-seeking behaviours of those with psychiatric illnesses or those with mood or anxiety disorders. Studies of individuals with depression, for example, have indicated that those who need professional help frequently cite embarrassment and a belief in possible negative perceptions from others as reasons for not seeking that help (Barney, Griffiths, Jorm & Christensen, 2006). Similarly, other research in the domain of health has indicated that men are less likely to seek help for a range of health issues than are women, that there is a trend for men to delay seeking helping when they are ill and that this in itself constitutes a major health issue in some developed countries (Galdas, Cheater & Marshall, 2005).

In the educational domain help-seeking research has explored issues such as harassment by peers in elementary schools (Newman, 2003), tracking in mathematics classes (Butler, 2008), use of online and computer coaching techniques (Mercier & Frederiksen, 2008), goal orientation in classrooms (Karabenick, 1998; Karabenick, 2004; Karabenick & Newman, 2006) and failure to achieve academically (Newman, 2002).

A general finding of research has been that for several reasons those students who most need assistance are least likely to use effective help-seeking strategies; those who most need help are least likely to seek it (Ryan, Patrick & Shim, 2005). This finding is clearly consistent with findings from other domains and theoretical models have been developed which seek to explain a process of help-seeking, the tools that are needed and hence the reasons that some individuals who need help may not ask for it.

One model, that of Newman's (2002), refers to a 'tool kit' possessed by self-regulated learners and it is this model which has informed the current exploration. In this model a self-regulated learner has the following competencies and resources available for effective and adaptive help-seeking:

a) Cognitive competency; learners know when help is necessary, know that others can provide that help and know how to ask for help;
b) Social competency; learners know who is the best person to ask for help and know how to ask for that help in ways that are socially appropriate;
c) Personal motivational resources; learners have appropriate personal goals, self-belief, self-efficacy and a willingness to express to others a need for help; and
d) Contextual motivational resources; classroom factors are in place including appropriate learning goals and grading systems, an appropriate structure of learning activities and teacher expectations about student learning which will facilitate help-seeking (Newman, 2002).

In the context of this model it can be argued that while teachers have a significant influence on the contextual motivational resources available in the classroom it is the individual learner's competencies and personal resources which are likely to have a significant impact on their help-seeing behaviour.

A search of the literature, however, has revealed no research specifically exploring the help-seeking of students with disabilities. The general finding referred to above. that students who need help the most are least likely to seek it, would seem particularly relevant to this population. While teachers may put in place classroom factors which facilitate adaptive help-seeking, students with disabilities are likely to lack the cognitive and social competencies to make best use of those contextual resources. Nevertheless, it is these students who are increasingly being included in regular primary and secondary classrooms yet who have significant need for effective instructional techniques and personal learning strategies to expedite their classroom learning. If Ryan's (2005) conclusions hold true then it could be expected that students with disabilities, struggling to succeed in regular classrooms, would exhibit poor or inefficient help-seeking strategies. This would, in turn, contribute to poor learning outcomes and an increased dependence on external forms of instructional support.

OBJECTIVES OF THE STUDY

It was decided to conduct a preliminary investigation to explore the use of adaptive help-seeking strategies by students with intellectual disabilities in inclusive junior high school classrooms. In these classes students are sometimes supported by teacher aides but for the most part rely on the classroom teacher, their peers and on their own personal resources. It was anticipated that the findings of this study would provide some connections between existing research of help-seeking in the educational domain and difficulties being faced by educators of students with disabilities in the regular high school classroom.

Specific aims of the study described in this paper were; i) to explore the perspectives of students with intellectual disabilities in regular secondary classes regarding their use of adaptive help-seeking strategies, ii) to explore the perspectives of secondary teachers regarding the use of adaptive help-seeking behaviour, and iii) to identify specific adaptive help-seeking strategies used by students with intellectual disabilities in regular secondary classes.

METHOD AND DATA SOURCES

Three students with an intellectual disability, fully included at three different secondary schools in regional Australia, participated in this small-scale descriptive study. At each site, two lessons were observed and detailed records of these observations were maintained. A semi-structured interview was then conducted with each student in which they were asked to describe techniques they use to get academic help in the classroom and about their views of help-seeking more generally. Finally, a semi-structured interview was conducted with each classroom teacher in which the teacher was asked to describe help-seeking strategies of the target student and of the class more generally. All interviews were audio-taped for later analysis. Analysis of the interviews and observations was recursive, searching for trends and themes.

RESULTS AND DISCUSSION

There were several findings of this study. One was a suggestion that these students with intellectual disabilities were sensitive to the characteristics and goal orientations of the teacher. One student's explanation, for example, that he did not ask for help from peers because 'they need to get on with their work' seemed to reflect the classroom focus on individual learning rather than any personal concern for his peers. Under different conditions, in another class, this student acknowledged that he would ask for assistance from peers "a little bit". Other students were able to describe conditions under which effective help would be provided to them in these regular classrooms. Katrina, a student with a mild intellectual

disability in year nine noted that a teacher was willing to give further explanations when requested “she explained it a bit better . . . explained it in front of the whole class.” and that, indeed, “it happens in most of my classes when I don’t understand.”

Student’s willingness to engage with teachers reflected an awareness of a teacher’s ‘approachability’ and sensitivity to the student’s individual needs. This is consistent with other research which indicates that “a sense of personal relatedness with the teacher was important in determining who reportedly seeks help and who does not” (Newman & Schwager, 1993, p. 10).

All the students were able to describe strategies which they used to seek help. Most common was the strategy recommended by the teacher; that students having difficulty ask the teacher for help. While students with disability commonly described this strategy and were able to relate instances where they had asked for help, very few were actually observed to do it during this study. More commonly, students were observed to seek help, in a variety of ways, from their peers.

Teachers acknowledged that while seeking assistance from the teacher was the standard help-seeking strategy, students with disabilities did not often use this strategy. One teacher acknowledged that the usual sequence was to seek help from peers before the teacher. “Their first option is always to ask the person next to them . . . ask someone around them. Then, obviously, asking the teacher.” Explanations for student reluctance to ask the teacher for help related mainly to student social skills, “she is too shy”, or to perceptions of social status in the classroom “they don’t want to be singled out in front of the rest of their peers and therefore lose status”. That social status was identified a particular issue for students in these high school classrooms confirms other research findings which noted that “concern about potential embarrassment in front of the teacher may not have the effect on younger children’s decisions to seek help that it does at the middle school level and beyond” (Newman & Schwager, 1993, p. 11).

Teachers also noted that students’ help-seeking was related to their awareness of their own learning and that help-seeking was unlikely to occur if the student did not believe that it was going to be of assistance. One teacher observed that; “If they haven’t got a reasonable body of knowledge, and they have no idea what’s going on they won’t put their hand up at all. They’ll just sit there and pretend that they do, trying not to get into trouble. Just wait and try and sit it out indefinitely.” Another teacher agreed that “it takes a certain degree of understanding to be able to formulate a question that’s capable of being asked of the teacher. And so being confident that it’s not a silly question.”
One way that teachers indirectly provided help to students was, if their own efforts were unsuccessful, to refer the student to peers. Edith, a student with a mild intellectual disability in year eight recounted a time in a science lesson when she didn’t know what she had to do. She explained that the topic of the lesson was fossils and that “I put up my hand and asked the teacher”. Unfortunately when the teacher came over to her and provided a response to this request “I couldn’t understand her . . I said I didn’t understand. She just said ‘well, ask one of your friends’. So I asked one of my friends and they told me what to do.”

Students in this study referred to many situations, such as that just described above, where they asked peers for assistance provided the classroom context permitted use of this strategy. Some, but not all, teachers encouraged this strategy either by specifically directing the individual student to seek help from peers, by establishing a classroom culture where interaction was encouraged or by simply permitting students to seek help from peers.

Students, however, demonstrated a limited ability to evaluate the effectiveness of their strategy use in the classroom. Teachers described ways that students quite deliberately chose to sit with particular peers, interacting with them in ways that met individual needs.

One type of need was academic, where peers assisted each other in personally meaningful ways “they know what she needs because they are around about the same level”. Another, related, need was for social support, articulated by one teacher as “drowning men clinging together”.

Explicit instruction in adaptive help-seeking strategies was not observed. By their invitations to the whole class to ask the teacher for help, however, and by suggestions that students ask peers for help teachers indirectly acknowledged at least two useful help-seeking strategies. There was no explicit classroom organisational structure observed which might facilitate cooperative learning. Students with disabilities, however, were observed to seek assistance from selected peers who were in close proximity.

Earlier studies (Karabenick, 2004; Newman & Schwager, 1993) have indicated that when students perceive a greater emphasis on individual mastery of lesson content, they are more likely to seek help whereas in classes where students perceive a greater emphasis on individual performance, they are less likely to seek help (Ames, 1992). This finding was supported by the current small-scale study. In all classrooms, teachers stressed understanding of content rather than achievement of performance goals. It provides further evidence that for the encouragement of self-regulatory learning, a classroom context which focuses on student engagement, interest and effort will be effective for all.

Other research (Newman & Schwager, 1993) has also indicated that adaptive help seeking is more likely to occur where the teacher actively encourages questioning and this finding was supported in the present study. Further, teachers acknowledged the significance of students having some understanding of the extent to which help was needed and to which help would be useful. An extension of the teacher’s role to explicitly teach students how to monitor their own learning and how ask questions, the issues of cognitive competency was not evident. Although this study was limited in time and scope, teachers did not suggest that this activity was a deliberate aspect of their classroom teaching. Instead, their seemed to be a tendency to allow students with disability to use the resources and competencies they had available by creating instructional contexts where those resources and competencies could be used. On the one hand, this could be interpreted as a decision to encourage student’s self-reliance. On the other, however, it indicates an area where more explicit teacher intervention may have significant benefits for students with disabilities.

Students in this study were observed to be demonstrating use of some ‘personal resources’ described by Newman (2002), specifically a level of social competence which enabled them to identify acceptable peers from whom help could be sought. Teachers saw help-seeking from peers as an appropriate strategy for students in this class and were explicit in their instructions to students. Through use of adaptive help-seeking strategies such as asking an appropriate peer in an appropriate manner, these students were thus meeting their own social goals, for affiliation with peers, as well as meeting academic goals (Newman, 2002). It is not clear, however, whether the achievement of social goals, being accepted by at least some peers, is related to achievement of academic goals. Current levels of help-seeking and help-giving between peers may mean that students with disabilities are unobtrusive in an inclusive classroom but it does not necessarily mean that these students can be described as efficient and self-regulated learners.

CONCLUSION

Help-seeking is an important self-regulatory behaviour (Le Mare & Sohbat, 2002) and there is a significant body of research which provides support for explicit instruction in cognitive and metacognitive strategies to enhance self-regulatory learning (Marfo, Mulcahy, Peat, Andrews & Cho, 1991; Mulcahy, 1991; Peat, 1994; Pintrich, 2002). A key finding of this small-scale study was that although students were often ‘permitted’ or encouraged to seek

help from peers, explicit teaching of help-seeking skills was not a feature of the observed lessons.

Help for students with disabilities in the regular classroom is often provided by adult helpers, such as teachers or teachers' aides this help which includes making decisions about when help is needed and the type of help that will be provided. It can be argued, however, that under these circumstances students with disabilities are failing to learn the skills that will be necessary for them to be self-regulating individuals beyond the years of formal schooling. Instead, instructional approaches with a focus on explicit teaching of adaptive help-seeking strategies is recommended as a means of making regular classrooms more inclusive.

A subsequent study is being planned in which teacher's observations of the help-seeking strategies of students with disabilities in a larger number of classrooms will be sought. It is anticipated that through an increased understanding of student strategy use and classroom instructional practices some directions may be identified for developing the self-regulatory skills of students with disabilities in inclusive classrooms.

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GIFTED ABORIGINAL STUDENTS: MAKING THE PATHWAY ACCESSIBLE

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Abstract

In this paper, two successful programs for gifted Aboriginal students are outlined. The first program, the Aboriginal Summer Schools for Excellence in Technology and Science (ASSETS), is for secondary students who show high aptitude in science, mathematics and technology. As well as excursions, recreation and other social activities, it offers a balance of academic curriculum, which features collaborative project-based learning, and cultural development, which involves interaction with elders and role models. The second program, the Wii Gaay Project, is for underachieving and 'invisible underachieving' primary students. It has adopted the Coolabah Dynamic Assessment model to identify gifted Aboriginal students, and provides suitable educational experiences that will enable them to attain their potential within the education system. The success of each program is due to the culturally appropriate identification model used and the holistic provision of activities that meet both the cognitive and affective needs of the students.

EXCLUSION FROM EDUCATION

Education has failed Indigenous students as for decades they have remained the most disadvantaged Australians on all socio-economic indicators (Craven & Marsh, 2004, p. 1). The disparity between the culture of Aboriginal students and that of most educational institutions (Manu'atu, 2000) and the hegemonic structure of educational institutions (Zevenbergen, 2001) are seen to be the major causes of the disempowerment of Aboriginal students and subsequently of their under-achievement in education. Certainly, Aboriginal people and Aboriginal communities have experienced generations of effective exclusion from the education process. This has often led to a lack of belief in the education system and a lack of trust in schools and in teachers (Ogbu, 1996).

Indeed, all indicators of academic performance in schools tell the story that, on average, Aboriginal children are performing chronically below the rest of the Australian population. For example, the 2003 PISA data highlight an over-representation of Aboriginal Australians in the lower achievement categories (Thomson et al., 2004). Furthermore, this disadvantage is magnified for many rural Aboriginal students who must also wrestle with cultural and racial prejudice issues. The historical view that Aboriginal students are less intelligent than non-Aboriginal students is still apparent in Australian society (Gibson, 1998), and Craven and Marsh (2004) confirm that Aboriginal students have lower academic self-concepts than their non-Aboriginal peers.

It is not the case that Aboriginal parents and their children do not recognize the significance of education and do not desire to succeed. Rather, many Aboriginal students describe a lack of encouragement from their classroom teachers, and believe that their teachers do not support high educational aspirations for Aboriginal people (Richer et al., 1998). Hence, the low participation rate of Aboriginal Australians in education is related in part to the emphasis on a Eurocentric curriculum, second-language issues, and lack of Aboriginal role models, at least in the case of post compulsory schooling and higher education and training (Kenyon et al., 2001).

One major reason why this underachievement has persisted for so long, it seems, is that most schools remain unaware of the intricate interaction of performance inhibitors, which include low self-efficacy towards education, fear of failure, trust issues and the forced choice dilemma, and the very real effects that these have on Aboriginal children. The forced choice dilemma (Gross, 1989) refers to the choice that gifted young people often have to make

between excelling in an area of talent that is not valued by the peer culture, and being accepted by that peer culture. Consequently, effective strategies to reverse underachievement, in particular underachievement by gifted Aboriginal children, have been difficult to find.

Aboriginal children are subjected to performance inhibitors, which include low self-efficacy towards education, fear of failure, trust issues and the forced choice dilemma. The forced choice dilemma (Gross, 1989) refers to the choice that gifted young people often have to make between excelling in an area of talent that is not valued by the peer culture, and being accepted by that peer culture. One major reason why significant underachievement has persisted for so long, it seems, is that most schools remain unaware of the intricate interaction of these performance inhibitors, and the very real effects that these have on their students. Consequently, effective strategies to reverse underachievement, in particular underachievement by gifted Aboriginal children, have been difficult to find.

Considerable support is given to assist Aboriginal children with learning difficulties. However, little attention is given to the identification and development of high academic abilities of Aboriginal children (Chaffey, 2002; Vasilevska, 2005), and this is reflected in the very low representation of Aboriginal children in programs for the gifted (Montgomery, 2001). In comparison with their non-Aboriginal peers, a much lower percentage of Aboriginal students is identified to be gifted, although, as Frasier (1997, p. 498) notes, 'There is no logical reason to expect that the number of minority students in gifted programs would not be proportional to their representation in the general population.' All too often, gifted Aboriginal children are underachieving and 'invisible' in our schools.

Historically, it has been notoriously difficult to identify gifted children coming from a background of disadvantage, including socio-economic disadvantage and cultural minority status. Chaffey et al. (2003) highlight the fact that many gifted Aboriginal students remain unidentified by traditional methods. They emphasise that many gifted Aboriginal children are not enabled to meet their potential, are usually viewed as average students by their teachers, and, because of the forced-choice dilemma, either consciously or unconsciously maintain their status of 'invisible underachievers'. Hence, the problem appears to arise partly from low expectations of Aboriginal students by their teachers, and partly from the methods used by schools and teachers to identify giftedness. Achievement and aptitude tests, teacher rating scales, and IQ tests are typically underpinned by complex cultural layers, and can fall far short of identifying the potential of gifted Aboriginal students.

It is generally accepted (see, for example, NSW DET, 2004; Montgomery, 2001) that it is appropriate to identify gifted students, including gifted Aboriginal students, using multifaceted identification methods, which include forms of parent, teacher, peer and self nomination, behavioural checklists, culturally appropriate measures of aptitude and ability, academic grades, tests of creative ability, evaluation of responses to a range of classroom and out of school activities, community recognition, observation and anecdotal evidence, interviews, and dynamic assessment. Such methods are effective in identifying gifted Aboriginal students only if they are applied in a holistic, whole-school model, as in the 360° assessment and feedback model of Ariyaratne et al. (2006). Currently, it appears that the only way to identify the learning potential of 'invisible underachievers', at least in Australia, is by a culturally appropriate form of dynamic assessment that addresses the perceived causes of their underachievement (Chaffey et al. 2003; Merrotsy, 2006).

Identification of giftedness should imply an adequate educational response that addresses the cognitive and affective needs of the student. Unfortunately, programs for Aboriginal students typically follow a deficit model with a remedial approach (Gibson, 1998; McCluskey, 2000). However, gifted Aboriginal students need an appropriate and challenging curriculum to engage, enrich and extend them, as well as support to realise their potential. While

reasons for high percentages of Aboriginal youth leaving school may be well documented, according to Schwab (2001) the methods for engaging learning are not well understood. Assisting gifted Aboriginal students to recognize their high academic potential and to translate this into high performance necessitates more than curriculum access. For example, students must deal with racial stereotypes and bridge the cultural gap created by dominant educational structures. Torrance et al. (1998) describe how positive role models can guide strategy use and show students how to deal with racial and cultural stereotypes.

That is, many Aboriginal students face disadvantages and challenges in accessing an education that most other Australians take for granted (Lyons et al., 2006). Schwab (2001) suggests that much can be learned for disengaged Aboriginal youth by examining successful programs. In this paper, we outline two successful programs for gifted Aboriginal students, one for secondary students who show high aptitude in science, mathematics and technology and the other for underachieving and 'invisible underachieving' primary students.

As Schwab (2001) notes, 'The engagement of Aboriginal students at the late secondary level is clearly related to their sense of self-esteem and the most successful programs seem to be ones that validate and celebrate Aboriginal culture' (p.x.). The first program discussed in this paper is the Aboriginal Summer Schools for Excellence in Technology and Science (ASSETS). In describing the conception of ASSETS, Barnes (1993) explains that gifted Aboriginal students have always been underrepresented in mainstream science and technology summer schools. This gap has led in part to a disproportionately small number of Aboriginal people in science, mathematics and technology-related professions. The ASSETS program seeks to address this gap by offering students a challenging, well-supported experience of experimental and discovery projects. It is:

> A balance of academic curriculum, excursions, cultural and social activities, and recreation. This holistic approach ensures that participants not only have the opportunity to improve their academic skills but are able to visit places of scientific and technological interest, meet interesting people, practise social skills, display pride in their Aboriginal cultural heritage and relax with their Aboriginal and non-Aboriginal fellow Australians (ASSETS, 1996).

The second program to be discussed in this paper is the Wii Gaay Project. The Wii Gaay Project has adopted the Chaffey (2002) Coolabah Dynamic Assessment tool in order to identify gifted Aboriginal students, who include underachieving gifted students (students previously identified to have high potential) and invisible underachieving gifted students (students not previously identified to have high potential). The assessment seeks to optimise cognitive performance by addressing perceived causes of academic underachievement, which include low self-efficacy and low teacher expectations. Chaffey's Coolabah Dynamic Assessment method has been adopted by public and independent education bodies in several regions of Australia as well as in New Zealand and Canada.

PROGRAM 1 – ASSETS: ENGAGING HIGH ACHIEVING STUDENTS

The ASSETS program is designed to provide for gifted Aboriginal and Islander children what has long been the right of other children. … It aims at enriching students from the scientific and mathematical viewpoint and empowering students with information technology skills (Barnes, 1993, p. 1).

Aims

ASSETS, an initiative of the Faculty of Aboriginal and Islander Studies at the University of South Australia, operated for almost 10 years up until 2000. Aboriginal students with academic promise were recruited from around Australia. Students from all secondary schools (government and non-government; city, regional, rural and remote) were eligible to attend. The students were expected to have an aptitude and interest in science, ICT and

mathematics and be moving into Year 11 programs with significant emphasis in these areas. After a break of several years, the ASSETS program has found support from several university and community bodies and has been reinvigorated, running again in January 2008. No preference is given to gender or location and the overall numbers have slightly favoured female students. In all, more than 250 Aboriginal students from around Australia have participated in ASSETS.

ASSETS has strong academic and cultural components. The academic program features collaborative, project-based learning that involves interaction with experts in the field. The cultural program involves interaction with elders and role models that enables personal growth and development of leadership capabilities as Aboriginal young people. The main aims of ASSETS are to:

- identify young Aboriginal and Islander secondary students who show potential for careers in technology and science;
- overcome anticipated difficulties in the coming school year;
- provide intellectual enrichment and exposure to successful professional role models; and
- increase nationally the number of Aboriginal and Torres Strait Islander graduates in the sciences.

Participants

During 2007, approximately 30 Year 10 Aboriginal students were invited to participate in the ASSETS program in South Australia. Selection criteria included academic ability, teacher and community recommendation and recognition of a broad range of outside achievements. This multi-faceted approach acknowledges Montgomery's (2001) assertion that effective identification of Aboriginal students as gifted must incorporate multiple methods.

While the selection is based partly on performance in the Collis and Fromberg (1992) mathematics profile, academic potential according to school and teacher recommendations play an important role. In addition, students provide a written statement of their reasons for applying for the program. All costs including travel, accommodation and food are covered in full through the project. The residential program is jointly developed and administered by Aboriginal house parents and educators.

Academic and Curriculum Projects

The core curriculum has varied over the life of the program but invariably it has included technology skills, current science information and skills and mathematics challenges. The program provides a range of content information and skills according to the chosen study projects. While students participate in some structured workshops, they mainly work in groups on projects facilitated by experienced scientists. An example timetable is included as an appendix.

Early years' project topics covered a wide range of subject areas and included: the use of computers to model the orbits of communication satellites, as well as the problem of ensuring that the satellite covers the right path of the globe; the design of a solar array using computers to ensure the best possible performance in a town like Alice Springs; the estimation of the height of the highest tree in the Botanic Gardens of Adelaide by working out the mathematical theory on which to base the estimation; Otoliths - ageing of fish from two different populations in S.A.; and Aboriginal presence on the Internet.

Later years' projects became more sophisticated, as availability of specialized equipment increased. For example, students studied sport shoe selection by investigating the performance of sports shoes based upon heel eversion in different situations. Another project entitled "Carried on the Wind" allowed students to examine the physics and

chemistry of radiation, the pathology and mechanisms of radiation sickness, and to evaluate epidemiological evidence in relation to the effects of radiation.

Strong connections with students' cultural heritage were evident in the project "Aboriginal People, Plants and Culture". In this project, students researched and documented the traditional knowledge of plants that allowed Aboriginal people to successfully live in a range of Australian environments for thousands of years. The intention was to promote wider community understanding of the breadth and depth of traditional knowledge and to exemplify true sustainability.

Projects have also incorporated students' interests with science. For example a project entitled Motivation and Emotion was a sports psychology project. Students conducted a research study to investigate the relationship between colour, sport and motivation. One of the highlights of the summer school has been the presentation of project findings by students on the final night of the program. Various political dignitaries, civic and academic leaders, and representatives of the Aboriginal and Torres Strait Islander community have participated in the closing ceremony for ASSETS. The evenings have combined music, didgeridoo playing, songs and high-quality visual presentations by the students.

Excursions, Recreation and Social Activities
Excursions expanded students' horizons, allowing them to see Aboriginal culture, science, mathematics and technology in action. The sites provided students with visions of possibilities for their own futures in science and their place in the world. Excursion locations have included:

- Australian Submarine Corporation
- Tjilbruke Trail
- Stockport Observatory
- Camp Coorong Mangroves
- Bushtucker cultural trail at the Botanic Gardens
- Investigator Science and technology Centre
- Warrawong Wildlife Sanctuary
- Tandanya – traditional art, dance and community

Social activities are of course important for all young people and allow students to get to know each other informally. Students have enjoyed pool parties, sight-seeing, beach trips, shopping, videos and barbecues.

Cultural
Workshops on Aboriginal culture, language and heritage have engaged participants in identifying their family heritage, country, personal stories and culture in a very supportive environment. Games such as an Aboriginal Trivial Pursuit assist students in developing knowledge and pride in their heritage. Numerous guest speakers have supported the ASSETS program over the years. "Their role is to share their particular work experiences which collectively cover a great diversity of backgrounds in education, business, research and Aboriginal experiences" (Steen, cited in ASSETS, 1996, p. 12). Selected topics include Aboriginal identity, evolution of communication technology and the benefits of Aboriginal people studying science.

Outcomes of ASSETS

Although the summer school is for 10 days, the effects are long reaching. Past students have reported outcomes that can be categorised as follows:

- Unforgettable enriching experience
- Positive life orientation
- Affirmation of skills and talents
- Building of confidence and academic self efficacy
- Inspiration from the successes of others
- Development of new skills
- Acceptance by an Aboriginal peer group of academic skills and abilities
- Impact on career choice

For many students, ASSETS is life-changing. One student wrote:

> When I came to ASSETS I was being recognised for being Aboriginal – it was something to be proud of. ASSETS provided me with role models to look up to, respect and follow. It boosted my self esteem and confidence … being accepted into ASSETS … I can still picture the look on Dad's face … It was the first time my Mum and Dad had ever verbalised how proud they were of me.

Previous participants often return to ASSETS as program leaders and tutors. Broadening of horizons has encouraged some graduates to travel and participate in exchange programs overseas: for example, one student spent time as an exchange student in Brazil.

Prior to ASSETS, some students with aptitudes for mathematics and science could not see the relevance of what they were learning. One particular student, who liked the sciences and was a keen sportsman, stated that through ASSETS he could see how science knowledge could be used to solve real-life problems. In addition, for the first time in his life he saw examples of people with an Aboriginal background succeeding in the field of science and technology. This student has now completed a Bachelor of Arts in Sports Science and Administration.

Although statistics are not available on Year 12 completion for the ASSETS program as a whole, 65% of 1992 ASSETS participants completed Year 12 in comparison to 25% of the Total Aboriginal population. Of the students who completed Year 12, 81% elected to continue with tertiary study. ASSETS graduates have selected study in a myriad of fields such as music, psychology, design, health care, apprenticeships, the Navy and architecture. In addition, a number of students have pursued careers in science. In 2006 an ASSETS graduate completed a PhD in a science-related field and is now working full time as a research scientist.

Dr Bin-Salik (ASSETS, 1999, p. 3) was quoted in the National media as saying, "We always had bright kids in our communities – what we aim to do is to get students to realise their potential… but more importantly to extend them… and just to make that possible – you can't begin to imagine how that makes you feel!"

ASSETS: Now and the Future

Following support from SiMERR, University of SA, Flinders University, Wiltja, the Australian Science and Mathematics School, and Dare to Lead, the ASSETS program was reinvigorated. While the main aims for the program remain the same, the vision for the program has altered with time. Current students are much more technologically capable and do not require the same level of support to learn basic technology skills. In addition, project possibilities have become far more sophisticated in the past few years. Students in 2008 studied units on Forensic Science, Robotics, Wetlands, and Health. Scientists and educators

worked together to plan a relevant and engaging experience for the students, and inquiry projects in each of the areas challenged the students and maintained their interest.

A summary of the 2008 academic program follows.

Week 1: The program introduced students to different areas of science and what scientific inquiry is. Teacher-directed activities and guest speakers/workshops in each of the 3 Project Areas helped build a knowledge base for students to work in "Expert Project Areas" the following week.

Week 2: The program was more open-ended to allow students to work in "Expert Project Areas" environmental science (wetlands), electronics/robotics or health sciences. There were negotiated workshop sessions for students to develop content knowledge and skills in areas of inquiry. Groups of three were arranged as 'Expert Project Groups', and involved a more complex understanding of the project areas. Time spent in Expert Project Groups included the opportunity to participate in data gathering to answer an inquiry question.

The success of ASSETS can be explained by the holistic nature of the program. The program incorporates academics, well-being, culture, sport and recreation, and identity. This program has allowed students to visualize themselves in careers that they had not previously considered.

PROGRAM 2 - WII GAAY: REACHING UNDERACHIEVING GIFTED STUDENTS

The identification of intellectually gifted Australian Aboriginal children and the provision of suitable educational experiences that will enable them to attain their potential within the education system are both significant issues. The Wii Gaay Project (Merrotsy, 2006) in northwest NSW offers an example of a model that is proving to be effective both in identifying underachieving and 'invisible' underachieving Aboriginal children who have high academic potential, and in reversing academic underachievement by addressing the issues perceived to contribute to it. *Wii gaay* means *clever child* in the Gamilaraay language.

The Wii Gaay Project has three components: effective, quantitative and culturally appropriate identification; appropriate intervention and long-term provision; and community involvement. Indeed, community involvement is central to the whole project, which is reflected in three ways. First, members of the Aboriginal communities participate in all aspects of planning, development and implementation of its programs. Second, there is widespread parent and community consultation and community awareness days. Third, individual Aboriginal adults participate in the identification process and the intervention program, and act as role models and mentors. Community involvement is not only possible but is necessary if the learning needs of the children are to be adequately addressed.

Identification

In the Wii Gaay Project, the children are assessed using the Coolabah Dynamic Assessment (CDA) method (Chaffey, 2002) as the principal tool. It has been developed to support an early intervention program by identifying children in Year 3 (approximately 9 years old). It is a quantitative measure that intends to be culturally appropriate. In the Australian context, it currently appears to be the only effective way of identifying high academic potential in children who come from a background of disadvantage, either cultural minority status (Chaffey et al., 2003) or low socio-economic status (Merrotsy et al., 2008). It is also proving to be very effective in identifying high academic potential in Canadian First Nations children (Chaffey et al., 2005).

Chaffey's (2002) CDA process comprises a pretest which uses the Raven's Standard Progressive Matrix (RSPM), a two-hour intervention which attempts to optimise cognitive performance, and a post-test which again uses the RSPM. As such, CDA does not claim to

assess learning potential, neither in the sense of the term for Kanevsky (2000), nor for Grigorenko and Sternberg (1998): after all, there is no real indication of a starting point from which to measure increase in learning or rate of learning, and there are no appropriate norms for the readministered RSPM. Rather, CDA gives an indication of academic potential when the perceived barriers to learning have been removed (Chaffey & Bailey, 2006). Hence, when applied to a group of children, CDA gives a ranking that can be used in a talent pool model for on-going intervention.

To apply CDA appropriately, training is imperative. The initial training comprises three sessions of two full days each, with theoretical and practical assignments following each session. Some of the causes of low self-efficacy strongly suggest that, in order to best identify high academic potential in underachieving Aboriginal children, Aboriginal educators trained in CDA are necessary.

Each year there are about thirty children involved in the Wii Gaay Project. They enter the program when they beginYear 4, and graduate from the program when they have completed Year 5. Two of the graduating children, a boy and a girl, are selected to be Year 6 role models for the younger children.

Intervention

In the Wii Gaay project, specific strategies are employed in a long-term intervention program that addresses the perceived causes of underachievement in the identified children so that they may attain their academic potential. In particular, the children are involved in enjoyable activities in a safe, comfortable and pressure free environment, and with a focus on intrinsic motivation through mastery and self-efficacy enhancement. The activities develop a positive attitude towards learning by establishing trust, increasing metacognitive knowledge and control, addressing cognitive and affective (both social and emotional) development, and ensuring constant success through scaffolding and support, and by providing performance and attributional feedback. The project also provides peer role models and adult mentors, and includes a program of school development and teacher professional learning.

The intervention program is implemented in two ways, through camps and through on-going activities in school, and it is important that these two components are closely related.

Each year, the children participate in two three-day camps. For some children, attendance at camp involves a six-hour trip each way. At the camps, they are involved in literacy, numeracy, and information and communication technology based activities that increase cognitive efficiency, develop basic skills, and build on other areas of need such as research techniques. The facilitators of this part of the program are acclaimed school and university based educators. The various tasks are thematic and are designed to challenge the students, who continually receive mastery feedback and scaffolding of information to ensure that they always experience success. Aboriginal community leaders also involve the children in a diverse range of cultural and relationship building activities. Throughout the camp, of course, the children are surrounded by like-minded peers. This has a number of advantages including self-efficacy development by peer comparison (Bandura, 2003) and the removal of peer pressure that often occurs in school by doing well and standing out (cf. the forced choice dilemma, Gross, 1989). Two leaders, chosen from Year Six *graduates* of the previous year's program, attend the camps to act as peer role models for the younger children. A respected and high achieving Aboriginal person from the wider community also attends the camp to act as a mentor and to enrich the vicarious experiences of each child.

After camp, there is on-going support for each child within their school setting. First, the isolation and the large distances involved in the project area make the use of the internet as a communication tool almost essential. There is an on-line forum for the children to maintain their friendships and to support one another. Second, during the three weeks after camp, the

adult Aboriginal mentor from camp acts as an on-line mentor for each child. At other times, Aboriginal people who are positive, academic role models are introduced to the program, and they interact with each child by email once a week for three to four weeks. Third, each term the project field officer sets each child a series of tasks to complete. The aim is to improve underdeveloped academic skills and to increase engagement by using tasks that are enjoyable and that respond to the child's preferred learning style. Self-efficacy is further developed by mastery in their tasks, appropriately supported by scaffolding and feedback. A project field officer also supports each child by visiting them in their school, and the opportunity is taken to discuss the child's academic, social and emotional development with their teacher.

RESEARCH FINDINGS AND DISCUSSION

The research component of the Wii Gaay Project collected quantitative and qualitative data on the effectiveness of the identification model used, on academic and affective gains for participating children, and on teacher attitudes and expectations (Merrotsy, 2006).

Identification

Each year since 2003, Chaffey's Coolabah Dynamic Assessment has been administered to the Year 3 cohort of Aboriginal students (i.e. about 150 students) in the Catholic School system in north-west New South Wales.

If the RSPM is administered, and then readministered about a week or so later, a child would be expected to perform slightly better in the second test due to familiarity with the test items. If the metacognitive intervention really does address causes of underachievement, then a child achieving to their potential should still perform slightly better in the second test (A1: see Table 1), whilst an underachieving child should make considerable improvement (P). Sometimes the child will perform worse in the second test (G1). Of course, some children perform at an extremely high level in the pre-test and do not need to have the intervention and the post-test administered. Note in Annie's case (achieving in the top 2% of normed scores for the pre-test) that her Year 3 Basic Skills Test results were Literacy Band 4 and Numeracy Band 3 (where Band 6 is the highest), and that her teacher thought that she was performing to her potential at the lower top of the class.

As well as Annie, the other 12 children from the one cohort who, in the post-test, performed at the 90th percentile or above were invited to join the Wii Gaay program. As can be seen in Table 1, and it is worth emphasising, their pre-test scores are typically in the middle of the range: they are classic examples of 'invisible gifted underachievers'.

'Lizbeth is worth a special mention. Her post-test result is clearly not strong. Three months later, a far post-test was accidentally administered in which she scored poorly on the easier subscales of the RSPM but extremely well on the two hardest subscales. Her subsequent involvement in the program has proved to be a remarkable success story.

Table 1: CDA Pre-Test And Post-Test Results For A Cohort Of Year 3 Aboriginal Students

Student	Pre-test percentile	Post-test percentile
A1	50	73
P	14	75
G1	78	69
Annie	98	99
Matty	39	93
Kelly	43	93
B1	46	90
E	47	98
Danny	55	91
A2	64	95
T2	64	98
Z	66	96
R	71	91
F	71	98
T1	80	96
D	80	96
'Lizbeth	30	60

School Performance

School performance is commonly measured by state examination results, but better early measures of reversing chronic underachievement could well be participation in schooling and engagement in learning.

Table 2 shows the results for a cohort of Wii Gaay children in the Year 3 and Year 5 Basic Skills Tests in Literacy and Numeracy, compared with general data on state averages for all students and for Aboriginal students. The Year 3 tests were completed before the children were identified for the Wii Gaay program, and the Year 5 tests were completed near the beginning of Year 5 when the children had been in the program for about one year (subsequent data for Year 7 are not available). The data show that: in Year 3 the Wii Gaay children were slightly below the State average in both Literacy and Numeracy, which is significantly greater than the average for Aboriginal students; in Year 5 the Wii Gaay children were slightly above the State average in both Literacy and Numeracy, which again is significantly greater than the average for Aboriginal students. The only child to perform at Band 6 in Literacy was Annie.

Table 2: Basic Skills Test Results

Basic Skills Tests	Literacy		Numeracy	
	Year 3	Year 5	Year 3	Year 5
Wii Gaay	50.3	57.4	52.6	60.5
State	50.6	56.6	52.8	60.4
Aboriginal	45.7	51.8	47.6	53.9

School attendance rates for Aboriginal students are poor, and this includes Aboriginal children in the northwest region of NSW. The days absent for the Wii Gaay children is shown in Table 3 and presented as a percentage. Data are shown for all of the Wii Gaay children, as well as with one and then two outliers removed. The asterisk * signifies that one family

experienced some difficulties and sent their child away to stay with relatives for over three weeks. Two points are immediately obvious. First, there is a significant drop in the number of days absent from school, apparent over two years. Second, the number of days absent appears to be significantly low (or, if you prefer, the attendance rate appears to be remarkably high).

Table 3: Average Days Absent (Expressed As A Percentage)

Average % days absent	2004	2005	2006
Range	0–30	0–36*	0–20
All Wii Gaay students	9.2	6	4.2
Excluding LS	8.4	4.4	3.8
Excluding LS & BW	7.6	3.8	2.8

Class work, completion of most homework and participation in extended individual research projects indicate that each of the Wii Gaay children wants to learn and is engaged in their learning.

Self-Efficacy

Self-efficacy was measured using the Berman-Chaffey Scales (academic motivation adapted from Pajares, 2001, writing adapted from Pajares et al., 2001, and mathematics adapted from Pajares & Graham, 1999, and translated into the Australian cultural and educational context). For individuals, the scales do give interesting information, as shown by the case study children in Table 4 (scaled out of 3). Large changes in scores, whether up as for 'Lizbeth in Maths, or down as for Annie in School, appear to be significant. Consistently low scores, as for Danny, are certainly a clear sign that the child is unhappy and needs further support.

However, some caution is need in interpreting the group data. For example, the children like very much being a part of the Wii Gaay program. Their responses may reflect that they want to please the person who is administering the scales, or that they feel excited and happy about school and learning because they were on a camp and amongst friends and other children with like minds.

Table 4: Berman-Chaffey Self-Efficacy Scales Results For Case Study Children

B-C Scale	School 04	Read 04	Maths 04	School 05	Read 05	Maths 05
Annie	2.2	2.4	2.4	1.4	2.6	2.3
Kelly	2.5	2.6	2.9	2.4	2.9	3.0
Matty	2.6	2.3	2.3	2.5	2.7	2.6
'Lizbeth	2.3	2.1	1.8	2.6	2.4	2.6
Danny	1.3	1.2	0.7	1.4	0.8	1.1

Teacher Attitude and Expectations

There is a strong correlation between teacher estimates of student performance and the student CDA pre-test score (see Table 5). In all but one case (T3), the teacher estimated that the student was working to their potential or near to their potential at the estimated level of performance. In all but one case (T2), the teacher estimate of potential, with respect to their estimate of performance, was considerably below the potential indicated by the student CDA post-test score.

Table 5: Teacher Estimates Of Performance and Potential

Student	Pre-test percentile	Post-test percentile	Teacher estimate performance	Teacher estimate potential
Annie	98	99	LTOC	TP
Danny	55	91	UBOC	NTP
Kelly	43	93	LTOC	TP
Matty	39	93	LMOC	NTP
'Lizbeth	30	60	LMOC	NTP
E	47	98	MOC	NTP
T1	80	96	UMOC	TP
A2	64	95	UMOC	NTP
T2	64	98	TOC	NTP
B1	46	90	MOC	NTP
F	71	98	MOC	NTP
Z	66	96	MOC	NTP
R	71	91	MOC	NTP
D	80	96	MOC	NTP

(B=Bottom, L=Lower, M=Middle, OC=Of Class, T=Top, U=Upper, N=Near, TP=To Potential)

Part of the Wii Gaay Project consciously attempts to address teacher knowledge about giftedness and Aboriginality, about the education of Aboriginal students, gifted students and underachieving students in general, and about implementing recommended strategies in the classroom. However, some teachers express confusion and lack of understanding about the program, and some of their statements appeared to be ill informed and could be interpreted to be racist. On the other hand, others are enthusiastic about the value of the program and the effect that it is having on the children. As Matty's teacher said, "Obviously for so many of these kids, Wii Gaay has brought it out in them and they are achieving so much more. You can see the kids growing and really gaining that confidence to keep going."

Summary of the Research Findings for the Wii Gaay Project

Coolabah Dynamic Assessment appears to be very effective in identifying underachieving gifted Aboriginal children, in particular invisible underachievers. 'Lizbeth shows us however that some gifted underachievers still remain 'invisible' after the model has been applied. Certainly, the Wii Gaay children show high academic potential not only in their post-test results but also in the activities and projects that they do at camp and for the project field officer.

Even though the intervention program appears to give only modest academic gains for the Wii Gaay children, they are participating in school, they are engaging in classroom activities, they are spending considerable time several days each week completing homework, and they are involved in on-going individual learning projects. The process of identification and the recognition of high learning potential along with the intervention program appears to give benefits in terms of the affective development of the Wii Gaay children. They love being 'a Wii Gaay kid', they express positive attitudes towards learning, they are mostly happy at school, and they are able to relate and form friendships with like-minded peers, often for the first time in their lives. It is noteworthy that a large number of siblings of Wii Gaay children performed at a high level in the 2007 Basic Skills Tests, and have stated that they wanted to do well so that they too can be 'a Wii Gaay kid'.

Some responses to the teachers professional development program remind us that attitudes and expectations can be slow to change. Some teachers do not see the need to change their classroom practice, and believe that the identification and intervention process give the family unrealistic expectations of their child. Other teachers adjust their classroom practice, have a positive and supportive attitude towards their students, and have higher expectations of them.

DISCUSSION AND CONCLUSIONS

On the whole, gifted Aboriginal children and youth have not been afforded appropriate pathways for them to realise their potential within the education system. ASSETS and the Wii Gaay Project are both strong examples of effective programs that start to address the disadvantages and challenges faced by many gifted Aboriginal students. The fact that they are successful may be clearly seen by the participation and engagement of the students in their learning and in the decisions they subsequently make for their future learning. The success of each program is due to six key factors.

First, they are both holistic programs that respond to the cognitive and affective needs of the students. Importantly, both programs are intellectually rigorous, integrate social and cultural components with all aspects of learning, respond to the preferred learning styles of the students, and address the perceived causes of underachievement and lack of participation. Second, both programs provide opportunities for the students to meet other gifted students from similar backgrounds and to form relationships with peers of similar ability and from a similar background. Third, both programs give appropriate recognition of student ability, in a sensitive way that does not lead to embarrassment or ‘shame’ (in the Aboriginal sense of the word). Fourth, the programs provide teacher and mentor support and offer vicarious experiences through meeting highly accomplished Aboriginal people from the wider community. Fifth, the identification models used are more culturally appropriate than previously applied identification methods. Clearly, more research is needed on dynamic testing. To date, Chaffey’s (2002) Coolabah Dynamic Assessment is the only method that is able to identify high academic potential in underachieving gifted Aboriginal children, especially invisible underachievers. Such holistic models should form part of the identification tool kit of every school system, and be accompanied by professional learning focused on giftedness, Aboriginal education, and what it means to be a gifted Aboriginal student. Sixth, both programs give each student appropriate support to become autonomous learners, and to succeed in the mainstream education system. Even though the ethos in Aboriginal cultures is perceived to be egalitarian by nature (Gibson & Vialle, 2007), the capacity for individual autonomy is becoming more and more appreciated (Jones, 2006). That is, as Gibson and Vialle (2007, p. 208) note:

> Although there is collaboration and avoidance of competition generally, there is, nevertheless, a recognition that some children are born with specific talents, and they are encouraged to pursue excellence in those areas.

Indeed, in ASSETS and the Wii Gaay project the students are comfortable with the idea of presenting their work in front of true peers, of pursuing an academic education, and of achieving their high potential.

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NARROWING THE GAP WITH CONCEPT MAPS: FROM DOCUMENTS TO DOING

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Abstract

This paper presents an overview of some teacher professional development in mathematics and science. Primary, secondary and learning support teachers worked collaboratively using concept maps to present: sections of syllabuses; their own pedagogical content knowledge; and learning material to be used in the classroom. As part of the planning activity, teachers identified: appropriate teaching and learning sequences; essential background information for units of work; and potential problem areas that students might encounter. In addition, the use of concept maps as advance organisers provided a means for tracking student learning in the classroom. This paper therefore, picks up on the *Narrowing the Gap* conference theme of collaboration between researchers and teachers in professional learning activities aimed at expanding the repertoire of strategies that can be used to address educational disadvantage. The 'gap' referred to relates to the separation that can exist between the intent of syllabus documents and classroom practice with its many (student) conceptions about the interpretation of learning tasks. 'Narrowing' the separation was undertaken by teachers as they managed, interpreted and planned material for classroom use. In this article, this 'narrowing' process is represented in three stages, each based on the preparation of concept maps.

INTRODUCTION

The context chosen for this presentation comprises three key areas of teacher professional practice. These are the professional growth framework within which teachers currently work, the identified attributes of successful professional development, and the application of specific teaching and learning strategies that facilitate improved student learning outcomes. The focus on professional development programs has come about because of their potential effectiveness over other mechanisms, such as policy, in supporting the achievement of learning outcomes (Supovitz & Turner, 2000).

Teacher practice within the Australian context is, in part, informed by the professional teaching standards which describe attributes of teachers at key career stages. (e.g., Teaching Australia, 2007). Such frameworks are supplemented with the descriptions of professional knowledge and practice that subject associations have compiled (AAMT, 2007; ASTA, 2007). Included amongst the elements of excellent practice and teacher expertise are three indicators that are relevant to the project described in this paper, namely, that teachers:

- Engage in professional development that is collegial;
- Actively explore new teaching ideas; and
- Initiate purposeful dialogue with students about their subject.

Kinchin (2008) has considered both the notion of expertise in teaching and the issue of how teachers engage students in the construction of their own expertise. He describes an 'expertise-based' model of teaching in which teachers are required to have the courage to share their knowledge, inclusive of any gaps in that knowledge. Implicit in this model is a dynamic interaction of knowledge structures between expert (teacher) and novice (student) that relate competence and comprehension. Such a model not only reinforces the central place of collaboration in teaching practice, but also sets the scene for the use of concept mapping as a tool for uncovering the knowledge base, practice and understanding of teachers.

Professional development priorities frequently include, *working with*, rather than *doing to*, teachers as an important component of successful programs (Ingvarson, Meiers & Beavis; 2005; Loughran & Gunstone, 1997). This approach is recognised as providing an appropriate mix of influences that contribute to professional growth. Affirming teachers as central agents in their own learning is also recognised by Clarke & Clarke (2005) as one of ten key principles that increase the likelihood of long-term and effective professional development. These principles can be used to identify the processes that teachers engage in during professional development programs. For example, addressing "issues of concern and interest, largely (but not exclusively) identified by the teachers themselves" that "involve a degree of choice for participants" (principle number 1, Clarke & Clarke, 2005). Failure to place teachers at the centre of any plans for reforming practice can only lead to disappointment in the achievement of positive outcomes particularly if those plans do not incorporate sustained activity (Gore & Ladwig, 2006; Supovitz & Turner, 2000; Van Driel, Beijaard & Verloop, 2001).

In the context of improving assessment practices, Black and Wiliam have undertaken a number of investigations that have highlighted guidelines for effective professional development (e.g., Black & Wiliam, 2007). They have identified a four-point scheme for development, some important features of which include:

- Teachers being supported to work together;
- Teachers incorporating ideas into classroom practice;
- Teachers balancing the requirements of curriculum imperatives and meaningful learning; and
- Teachers gaining feedback from peer/external review of their practice.

Such a scheme provides a working model for professional development that is based on establishing communities of learners who can reflect on their practice.

As a teaching and learning strategy that supports student learning, concept maps were chosen as the focus for professional development activities because of their benefits in making metacognition explicit. Ausubel's meaningful learning theory proposes that learners' cognitive structures are hierarchically organized with more general, superordinate concepts subsuming less general and more specific concepts by progressive differentiation and/or integrative reconciliation (Ausubel, 2000; Novak & Gowin, 1984). Through maps and diagrams, students illustrate publicly their interpretation and understanding of a topic or problem. As presented in their original forms, concept maps are hierarchical networks of interconnecting concepts (nodes) with linking words describing the nature of interconnections (Novak, 2002; Novak & Gowin, 1984; Schmittau, 2004). Concept maps provide a meta-learning tool that can be used by teachers and students alike to organize and reflect on their knowledge (e.g., Conlon, 2004; Fellows, 1993; Novak, 1999; Novak & Canas, 2008). Concept maps, together with the discussion that surrounds their preparation, provide an ideal reflective context for teachers as they interpret a new teaching and learning strategy, and plan for its implementation.

The professional development considerations outlined above, together with the potential benefits from applying a particular learning tool, helped to inform the design of the activities that formed the basis of the project. In particular it was important to ensure that the activities were collegial, provided the opportunity for professional discussion and feedback, were structured over time, and enabled teachers to engage students in meaningful dialogue about their learning. Above all, an important consideration for the project was how to facilitate the translation of curriculum imperative to meaningful student learning in the classroom. This aim is consistent with the conference theme in that it provided an opportunity to explore the 'gaps' between teacher (expert) knowledge and student understanding, and to investigate the process of 'narrowing' that 'gap' as teachers reflected on differing knowledge structures.

Equipping teachers with additional strategies that have a foundation in meaningful learning was seen as one option for the improvement of student learning outcomes in the classroom and, consequently, directed at minimising the emergence of any educational disadvantage.

METHODOLOGY

A two-day professional development workshop introduced ten teachers from an indigenous primary school and a K-12 independent school to the innovative use of concept mapping and Vee diagrams in mathematics and science. Vee diagrams are a metacognitive tool that links conceptual (thinking) and methodological (doing) aspects of problem solving. Concept maps are one component of the conceptual sequence of the Vee heuristic (Novak & Gowin, 1984).

Presentations were interactive allowing teachers to field questions for clarification of issues and ideas and to critique presented maps or diagrams. Familiarisation with the concept mapping technique was gained through discussions of examples of maps and diagrams previously constructed by secondary students and student-teachers to illustrate their applications. Two of these applications were, firstly, the analysis of problems and activities including the illustration and communication of one's understanding and, secondly, the planning of instruction required for teaching sequences and lesson plans.

Small group activities then provided teachers with the opportunities to work cooperatively to co-construct concept maps by brainstorming ideas, compiling concept lists, organizing concepts into meaningful hierarchies, constructing propositions, and including 'linking words' that described the meanings of these inter-connections. Teachers practised concept mapping of syllabus outcomes, specific problems, activities, and textbook extracts. Group presentations and peer critiques followed each group activity. These provided critical feedback to further improve the hierarchical organisation of concepts.

During the professional development sessions, participants reflectively considered how they might incorporate maps and diagrams into future planning and classroom activities. Teachers also experimented with maps and diagrams before meeting again in reflection sessions. The data presented included exemplars of teacher-generated concept maps prepared during the workshop, negotiated during reflection sessions, and constructed by primary students during classroom trials. Included also are excerpts from transcripts of workshops and reflection sessions to support the presented concept map data.

Maps were analysed from a qualitative perspective. This approach is in line with the practice that uses concept maps as an accessible technique for helping students and teachers organize their own knowledge (Feldsine, 1987; Fellows, 1993; Fraser & Edwards, 1987). A focus on the organizational features of maps provides insights into the diversity of knowledge structures that might not be identified in purely numeric scores obtained by an inspection of specific map constructs, or through a comparison with an 'expert' map (e.g., Dorough & Rye, 1997; Williams, 1995). In the context of this project, the analysis provided important information about: concept groupings; 'gaps' in knowledge structures; and the meanings generated by links between concepts.

Results are framed around the different roles enacted by teachers during three stages of the project, namely, teachers as:

1. learners of innovation – the *Planning by Teachers* stage;
2. reflective practitioners in a community of learners – the *Planning for Students* stage; and
3. classroom implementers of innovation – the *Student Learning* stage.

The examples of concept maps that are presented in the following sections were prepared by teachers during each stage of the project and have been selected to be representative of both mathematics and science topics.

THREE STAGES of 'NARROWING THE GAP' – THE CONCEPT MAPS

Stage 1: Planning by Teachers

After initial introductory sessions on the rationale and techniques for the preparation of concept maps, teachers worked in small groups on a number of tasks in two areas. The first was related to syllabus interpretation during which teachers represented the requirements of the syllabus and organised these requirements into a concept map. The second was about teachers' own conceptual knowledge for a specific topic during which they discussed collaboratively the essential understandings needed to begin preparing a teaching sequence about 'matter.' The rationale for completing these tasks was to identify the 'fit' between the guidelines for a defined body of knowledge (i.e., syllabus requirements), and aspects of the practice of a professional learning community (e.g., teacher content knowledge), and to identify any 'gaps' in these two forms of 'expert' knowledge. Each of the tasks is discussed briefly in terms of the potential benefits to the teachers as a community of learners.

Mathematics Concept Map

Figure 1 illustrates primary teachers' planning concept map about Addition and Subtraction for students in the middle years of primary schooling (Stage 2) based on syllabus material. The discussion which followed the presentation of this map highlighted two aspects of working as a community of learners: Firstly, the use of concept maps as an advance organiser provided a framework for discussion; and secondly, the discussion provided an opportunity for sharing ideas that reinforced aspects of good practice (e.g., in the use of maps as scope and sequence statements).

Presenter*: We've interconnected the two (addition and subtraction, and working mathematically) because they do relate to one another … we would begin with the two digit numbers and work our way through and build on that to the three and then the four. Once they've got the mental strategies in place we can then start to put it into the written from and written can be informal of formal. On the informal side, we looked at oral sentences where children explain what they are doing using concrete materials such as open number lines … but on the formal side we would look at the written algorithm… where we go from here you would have to do a concept map for two digits, then another for three …*

Teacher 1*: They make excellent scope and sequence statements.*

Teacher 2*: The structure … would be a series of lessons say over two weeks …*

Teacher 1: *You could photocopy a number of these and for each sequence of lessons highlight the relevant parts.*

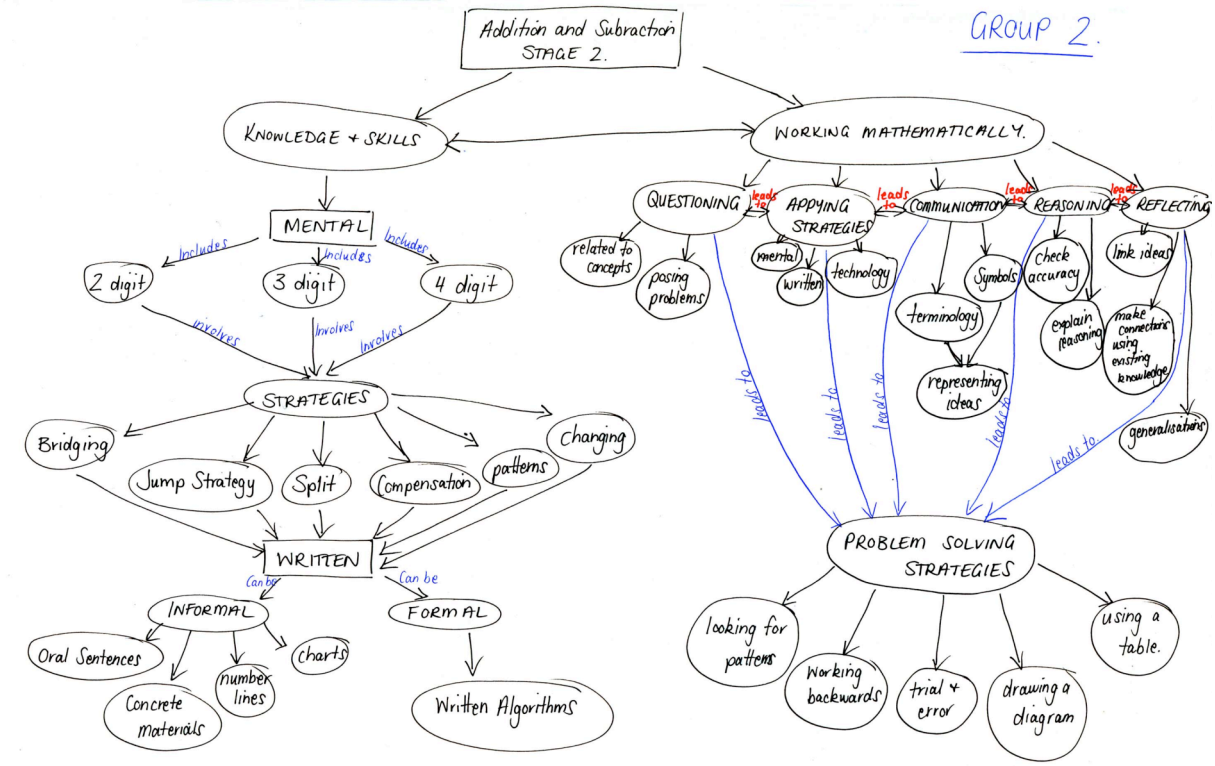

Figure 1: Concept Map for *Addition and Subtraction* Prepared Collaboratively by Teachers

'Matter' Concept Map

Figure 2 details the conceptual structure that represented one group of teachers' collective understanding about the topic 'matter.' During discussions about this map, the teachers focused on limits of knowledge. They discussed how much they knew, but also related this knowledge to what the students might know. Some representative comments include:

Participant 1: *We were thinking of the different* (learning) *stages where they would stop.*

Participant 2: *Yes, we had to work out where our knowledge ended too, because it did end there* (pointing to a section of the map); *we had to look up some books.*

Participant 3: *… it's interesting to see how much of what's on the board is a reflection of what is coming out of here* (pointing to the head) *and how much had been the organization of secondary sources.*

Participant 2: *Well when we got down to ions and things like that, we all sort of went 'no idea.'*

During their presentation, it was also clear that the sequencing of general and specific terms in the 'matter' map was uncertain. For example, the proposition that "particles are made up of molecules" illustrates that the two concepts ('particles' and 'molecules') have been integrated within teachers' own cognitive structures, but that the use of the term 'particle' in this instance is not a meaningful one. There had been progressive differentiation from 'particles' to 'molecules,' which is correct in the everyday sense of 'particle' meaning of a small portion of something. In order to lay the foundations for a scientific use of the terms, the relationship would need to be expressed as one of equivalence, such as, "particles can be molecules or atoms".

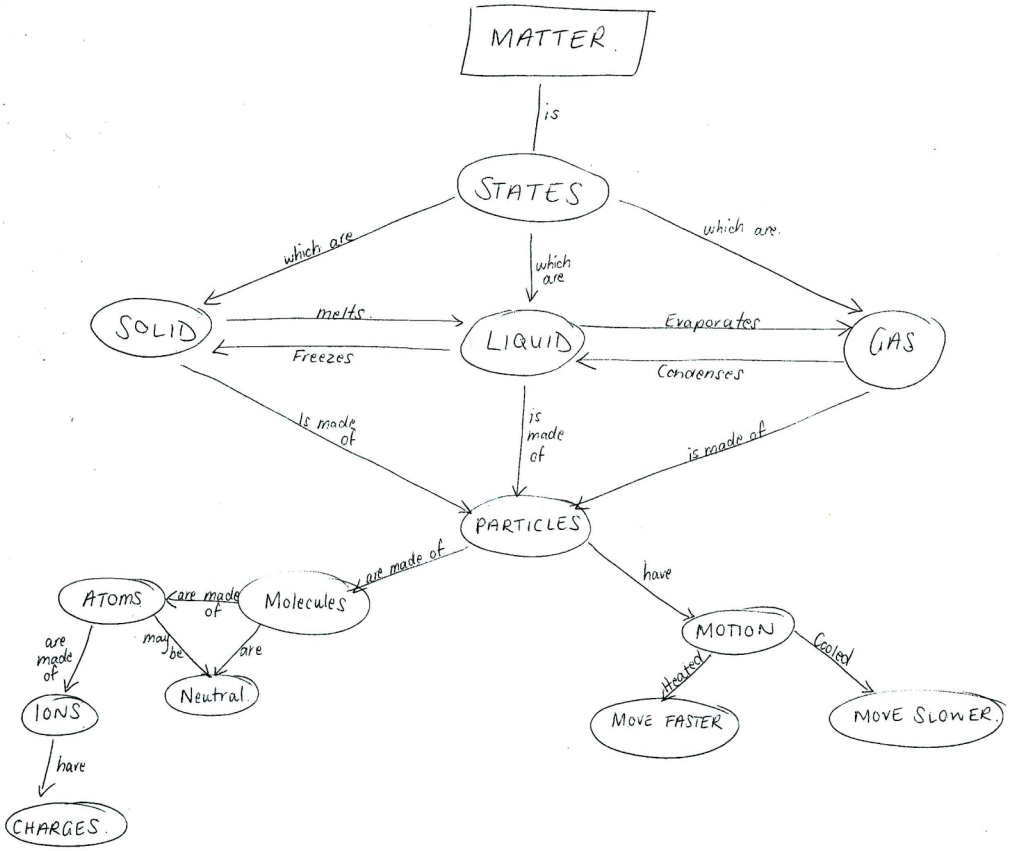

Figure 2: Concept Map for *Matter* Prepared Collaboratively by Teachers

This example then provides a useful starting point for a collaborative discussion about pedagogical content knowledge with positive outcomes for the classroom learning context. For students acquiring an understanding of the sub-microscopic world, it is important to know whether or not particles are made up of molecules, atoms are made up of ions, whether molecules are an instance of particles, and the nature of the relationship between atoms and ions. Resolving such issues prior to teaching a unit can help to avoid the generation of misconceptions.

As a planning strategy, one outcome from the preparation of this map and the subsequent discussions was the provision of an external focus for the evaluation of the extent of teachers' own knowledge. The collaborative process provided an open and supportive environment that led to the identification of 'gaps' in that knowledge. The two concept maps presented above provide instances of how teachers were engaged in the initial stage of the "documents to doing" journey. Important outcomes from their collaborative discussions included their use of diagrams to articulate the organization of syllabus content and these professional development sessions provided the opportunity to reflect on their pedagogical content knowledge.

Stage 2: Planning for Students

This section comprises two maps that were prepared collaboratively by teachers to detail the conceptual understandings needed for the introduction of the topics 'sound' and 'substances.' Each of the maps provides a basis for the organization and design of activities that are intended to facilitate the smooth transition between syllabus requirement and teacher pedagogical content knowledge on the one hand, and student learning and understanding on the other. The rationale for this planning stage was to continue the process of identifying any 'gaps' that might lead to unforseen learning outcomes, such as, the generation of misconceptions.

'Sound' Concept Map

Figure 2 details the conceptual structure that represented one group of teachers' collective understanding of the topic 'sound' and planning for introduction to students in the upper primary Years of schooling. A quote from the presentation by one of the teachers during discussion about the map is provided as an illustration of how text can be effectively transcribed into a concept map.

> *We decided to have three headings; we had amplification, resonance and strings. That's what sort of came with guitar. They can have amplification which could be electric or acoustic and it can vary according to the depth of the hollow chamber, so obviously the inside of the guitar. Sound has resonance which is related to movement of air, which result in vibration, which ends up as reverberation which then comes out as sound. Movement of air; again strings cause movement of air, so that should have gone that way and sound obviously can be made using strings, and strings can have different thickness which changes the sound; thick and thin which changes pitch to high or low, so if it's a thicker string it's going to have a lower sound, and if it's a thinner string it's going to have a higher sound. But if you tune it differently this could have the top string or the higher string or the thin string, could also sound low anyway. Strings can vary in length and can be made of material like steel or nylon strings depending on what it is, and the electric is going to be steel string and you can have nylon or steel strings for acoustic.*

I found the concept map allows you to put down all the information and you draw from that map for what you need.

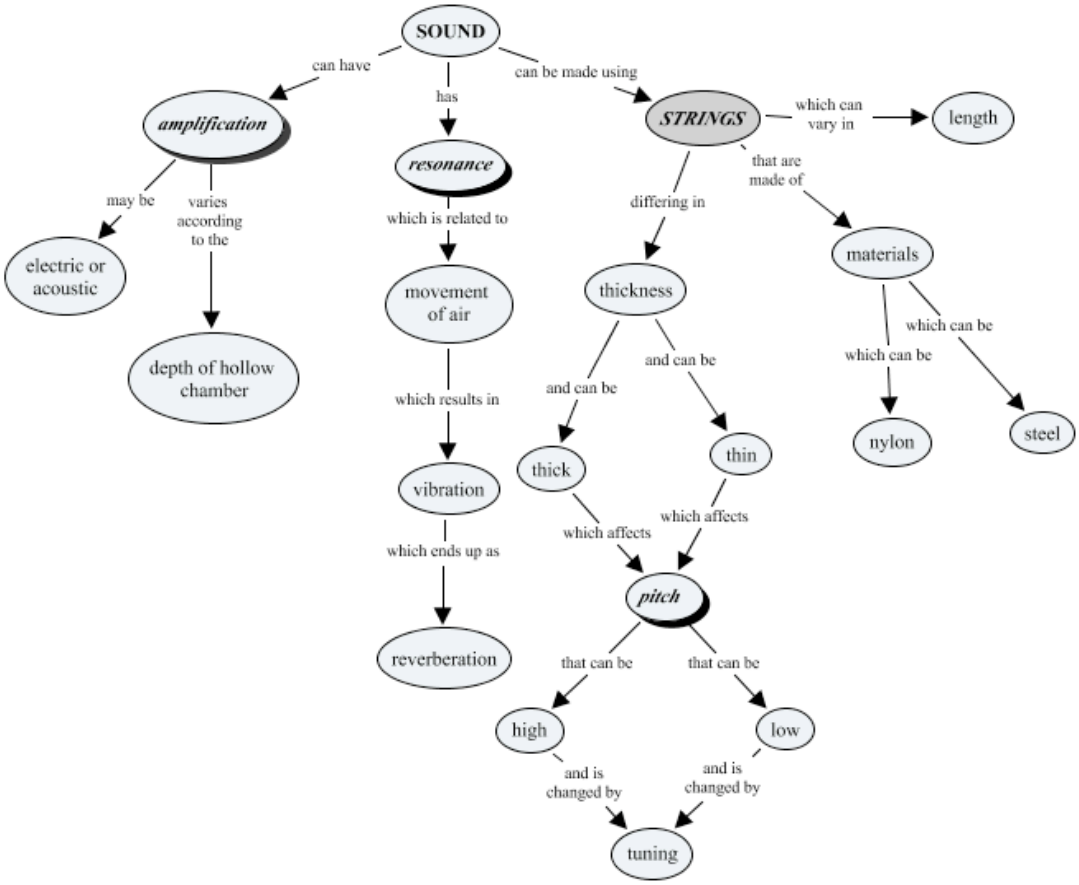

Figure 3 Concept Map for *Sound* Prepared Collaboratively by Teachers.

The main feature of interest in the content of this presentation and associated map is the breakdown into conceptual and concrete aspects of sound. The way each of these is detailed has implications for the learning experiences that might be planned for students. There are three main conceptual areas covered in the concept map, namely, 'amplification,' 'resonance' and 'pitch.' Their inclusion raises some points for consideration, the first of which relates to the sequence in which they might be presented. There are no links between the sections of the map in which these three concepts occur, suggesting that they would be presented independently. Secondly, the elaboration or progressive differentiation of each concept is minimal. For example, 'pitch' is described as high or low and that it can be changed by tuning. Finally, the inclusion of the concept 'pitch' also provides an opportunity to develop the idea of *properties* of sound. The idea that concepts and objects, such as 'sound' and 'matter', have defining attributes is an important foundation for future understandings in science. In an introductory unit on sound, it would not be unreasonable to expect that some attention be given to a description of sound in terms of at least one of its essential properties, such as, its pitch and that such a property can vary.

Where concrete aspects of sound have been considered (i.e., strings), the inclusion of 'thickness' and 'length' provide ideal contexts for developing practical learning experiences that would enable students to investigate variations in sounds produced. An additional feature of interest relates to instances of uncertain discipline knowledge. For example, the propositions that "sound has resonance" or "movement of air which results in vibration" have consequences for how descriptions of sound, or its production, might be presented to students.

'Substances' Concept Map

Figure 3 details the conceptual structure that represented one group of teachers' collective understanding about the topic 'substances' for introduction to students in the upper primary Years of schooling.

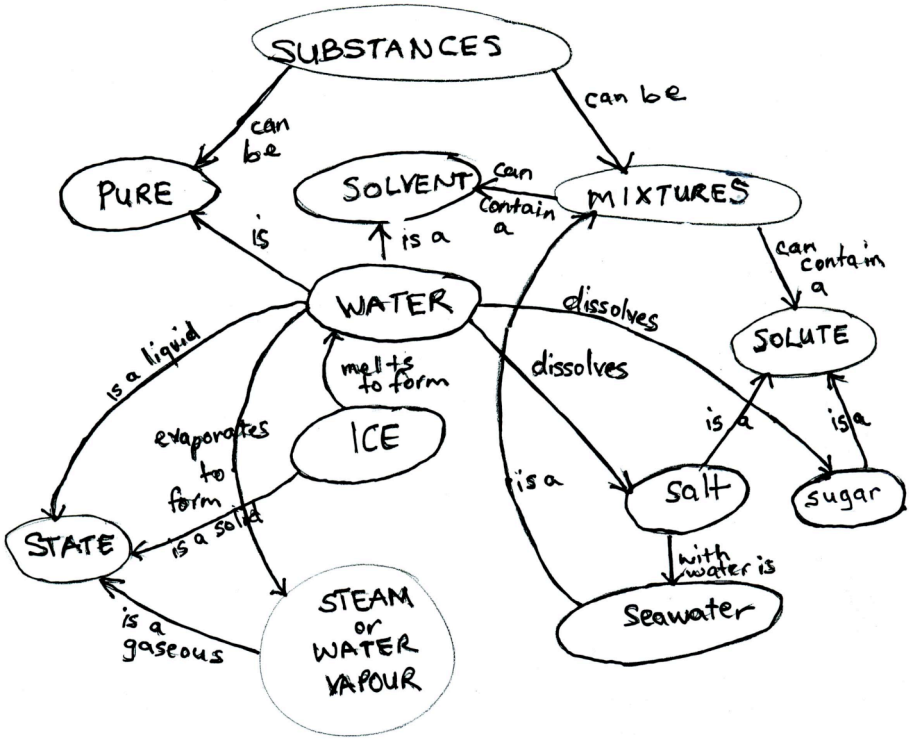

Figure 4 Concept Map for *Substances* Prepared Collaboratively by Teachers.

There are similarities between this concept map and the previous one (Figure 3, 'sound'). There are conceptual and concrete aspects of substances presented (e.g., purity, changes of state); the elaboration of concepts is minimal, with the longest sequence comprising three concepts (e.g., "substances can be pure," "water is a solvent," "salt with water is seawater is a mixture"); opportunities exist to develop the idea of 'property' (e.g., through the inclusion of concepts, such as 'purity'). In addition, 'water' has been used as a concrete example for both changes of state and for dissolving, and its inclusion sets the scene for some practical learning experiences for students to investigate these areas. In the discussion which followed the presentation of this map, there was a focus on sharing variations to the practical learning activities that helped to clarify the planning for students. Part of that discussion is presented below.

Participant 1: I think you should remember the Milo thing.

Presenter: Milo, that's a good one, because they could drink it at the end.

Participant 2: They would never forget.

Presenter: I like the jelly one as well; that's also a good one because salt water doesn't sound as attractive in comparison. We were trying to think of something with the sugar and water but we sort of didn't arrive at a conclusion.

Participant 1: The trouble with the jelly crystal one though is when it forms into a mixture, but it then forms into a solid sort of thing.

Participant 2: There are more factors there, it's not only the dissolving.

There are two important differences between this map and the previous one. The first is that there are a number of links between different conceptual areas in the map through the use of the concept 'water.' As indicated by the presenter, "It's a bit messy; there's a lot of crossing over … we put lots of links in." The second difference with this map is that there is no uncertainty with the discipline knowledge.

One important outcome from preparing concept maps during this stage in the "documents to doing" journey was the identification of the relative weighting given to conceptual and concrete aspects of topics. This identification then had implications for how teachers might support the development of conceptual understandings for students and how practical learning experiences might be sequenced. It was clear during this stage that collaborative discussions were an essential part of helping teachers to refine their own pedagogical content knowledge and to extend the range of activities that could be used as learning experiences.

Stage 3: Student Learning

This section comprises two student work samples that were prepared as part of the introduction of the concept mapping strategy into the learning environment. In common with the teachers involved in the program, none of the students had previous experience with concept mapping, and these represent their first attempts. The topics covered are 'the Moon' and 'fractions,' and they are a representation of students' understanding of discipline knowledge. One important benefit to teachers of this stage was the opportunity to focus on emerging (faulty) knowledge structures and areas of weakness that might require further attention.

'The Moon' Concept Map

Figure 5 represents the concept map drawn collaboratively by a group of primary students. There are three aspects of interest that could be used by teachers when engaging students in further learning of this topic.

The first aspect relates to the use of personally relevant language. As part of the sequence of propositions about seeing the moon, the statement "maybe nowhere" is used after describing its shape as either a crescent or as a circle. The statement may represent the students' lack of understanding that the moon still exists, but that at times is not visible to the naked eye.

The second feature of this map encompasses areas of misconceptions or faulty knowledge. These include the ideas that the moon goes around the sun and that the moon is white. The first of these might have been an unconscious error, but given that the students worked on this map over two sessions, its retention is of interest. The second of these ideas highlights the need to spend time describing the moon as an object, particularly its colour. Even though the notion of vision and how objects are seen in an emerging concept for students of this age group, the inclusion of this particular proposition in the map acts as a 'flag' for teachers to consider particular learning experiences for the future.

The third feature of the map highlights the students' facility with the incorporation of scientific language into propositions. Whilst the inclusion of 'warning gibous' and 'warning creasant' might be passed off as anticipated spelling errors, they do indicate that the terms are not yet integrated securely and can therefore alert the teacher to the need for considering additional learning experiences.

Each of the features highlighted in this map can be used by teachers to ensure that the ideas students have about the Moon are as complete as possible – given their age and Stage of learning. In this instance, learning experiences could be further developed that secure students' use of language, consolidate ways of describing objects, and reinforce foundational ideas about vision.

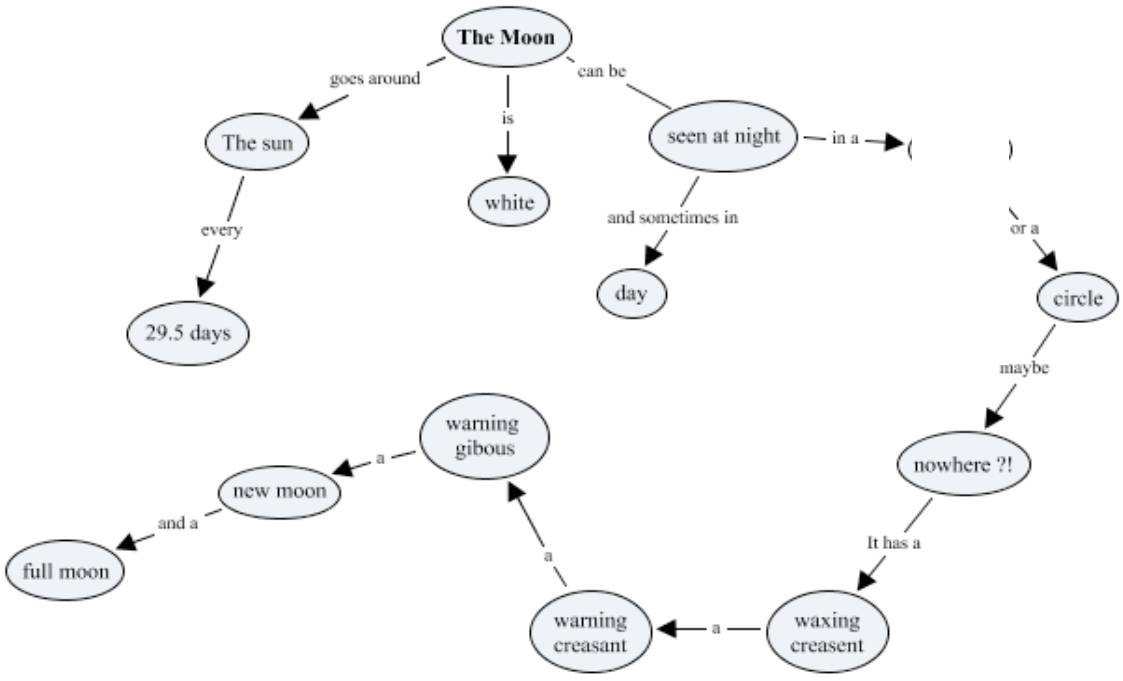

Figure 5: Concept Map for *The Moon* Prepared Collaboratively by Primary Students (Years 3-4).

'Fractions' Concept Maps

Figure 6 represents the concept map drawn by a student in the late primary Years (Year 6). There are four aspects of interest that could be used by teachers when planning further learning experiences for this student.

The first aspect relates to the demonstrated understanding of equivalence of fractions and percentages. This student is able to change numerators and denominators to write an equivalent fraction and also express the fraction as a percentage. The second aspect of their understanding concerns the representation of fractions in another form. The use of equally subdivided rectangles provides a visual representation of 'parts of a whole.'

The third feature is related to the subdivision of the whole. The strategy used for rectangles has been directly applied to circles for three of the fractions. That strategy can be described as drawing equally spaced vertical lines followed by equally spaced horizontal lines. This strategy can be applied to rectangles but not always to circles. The inclusion of the diagrams and the associated strategy for subdivisions is an indication that learning experiences are needed that support the acquisition of strategies for subdividing different shapes into equivalent areas.

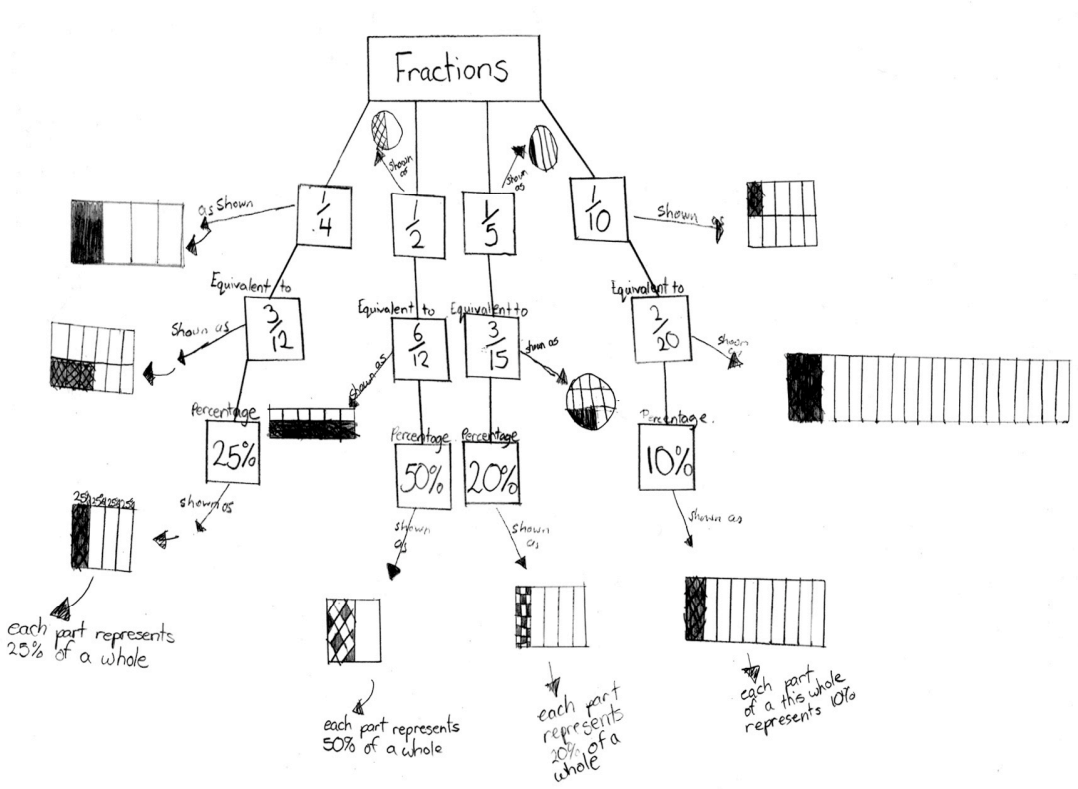

Figure 6: Concept Map for *Fractions* Completed by a Primary Student (Year 6).

The fourth feature of the concept map relates to the student's working memory. The map contains four strands of identical structure, i.e., fraction – equivalent fraction – percentage, with a diagram for each. The focus on maintaining structural accuracy over a number of attempts is an indication of how much information the student can process before ending the task. However, such a focus has not enabled the student to consider the effect that changing the shape would have for the subdivision of areas.

As with the previous concept map (Figure 5), this map provides guidelines for the development of further learning experiences. In this instance, those experiences would be directed towards a more complete understanding of fractions and their representations

An important outcome from the student concept maps prepared during this final stage in the "documents to doing" journey was the identification of the mix of differing knowledge structures. In both maps presented in this section, there is a mix of syllabus or discipline knowledge that has been integrated into students' understandings and students' personal understandings and strategies. Both of these representations of knowledge provide teachers with guidelines for sequencing further learning experiences.

AN ADDITIONAL PERSPECTIVE

Cultural factors provided the context for one additional 'gap' that was addressed in a concept map that represented planning by teachers using syllabus documents and a body of expert knowledge. Figure 7 represents the concept map drawn collaboratively by a group of primary teachers for the topic of 'mapping.' The breakdown into the separate areas of addressing knowledge and skills, and of working mathematically is similar to the concept map for 'addition and subtraction' (Figure 1).

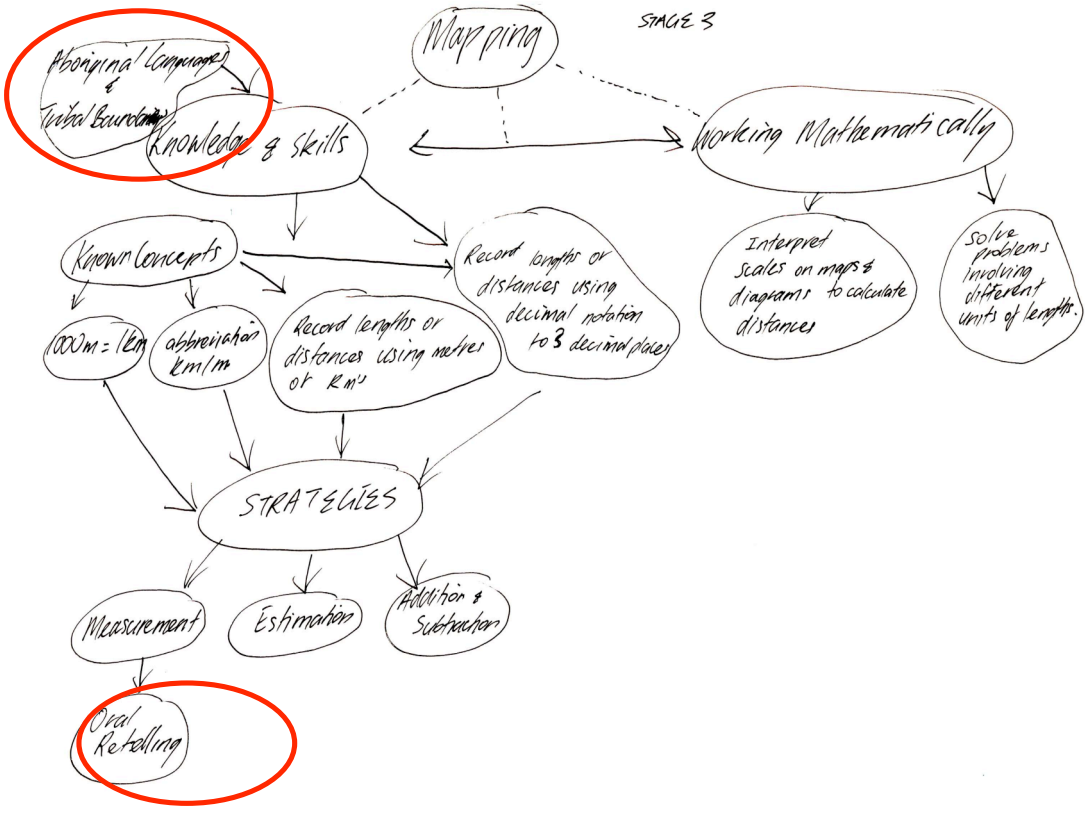

Figure 7: Concept Map for *Mapping* Prepared Collaboratively by Teachers.

Two features have been incorporated into the map to address cultural diversity and to contextualise the learning for some students. The first of these is the inclusion of 'Aboriginal language & tribal boundaries' within the *Knowledge and Understanding* section. The other inclusion is the use of 'oral retelling' within the *Strategies* for problem solving using measurement. The following is an extract from the presentation by one of the teachers in the group that prepared this map.

> *The knowledge and skills would include known concepts such as 100 metres is equal to one kilometre, abbreviations of kilometres and metres … I would also include Aboriginal language and tribal boundaries, like for example it (*the question sheet*) says how far from Tenterfield. I would say how far from Goombungee Country down to Bundjalung Country.*

SUMMARY OF FINDINGS

The concept maps presented in this paper have helped to document the professional development activities of teachers as they set out to "narrow the gap" between syllabus documents and students' understandings of discipline knowledge. This process was presented in three stages and the outcomes from each stage provide some important guidelines for teachers in the development of meaningful learning experiences for students. Throughout the project teachers were encouraged to think innovatively to consider additional pedagogical strategies that could be implemented in the classroom. The opportunity of *working with* teachers, rather than *doing to*, over time facilitated discussions that helped to strengthen their pedagogical content knowledge which, in the longer term, is one dimension of ensuring that disadvantage does not become a feature of the teaching and learning context.

Key features of the three stages of "narrowing the gap" were identified as:

- The preparation of advance organisers of syllabus material and discipline knowledge and their use to plan learning experiences;
- The opportunity to reflect on pedagogical content knowledge;
- The identification of conceptual and concrete areas within planned units of work; and
- The collection of evidence from students that highlighted the integration of discipline knowledge with students' personal understandings.

The project was guided by three key questions framed around how teachers would respond to an innovative teaching and learning strategy, how teachers might resolve identified issues, and how teachers would perceive the effectiveness of concept mapping as a planning tool. From the examples presented in this paper, some preliminary answers can be put forward. Firstly, teachers recognised the benefits of using concept maps and they created a collaborative and supportive environment in which they openly discussed the learning of a new technique and were prepared to present their initial maps for peer discussion. They produced a number of detailed maps for different contexts and used them to resolve problems that they perceived students would experience. Concept maps were produced as advance organisers for a syllabus topic that led to discussions about how student learning might be sequenced. Maps were also produced that outlined the conceptual structure for the introduction of a new topic. Teachers also used maps to identify the extent to which students had integrated knowledge and skills into their own understandings. The overall process of constructing maps reflected the dynamic interaction between expert and novice knowledge structures advocated by Kinchin (2008) as being an important component of an expertise-based model of teaching.

Secondly, the extended discussions during presentations or peer critiquing enabled teachers to share their knowledge, as well as add to and refine constructed maps. Through sustained conversations about subject matter by listening to each other's views about the important knowledge and skills that students need to acquire, teachers had the time to reflect and to gain a deeper understanding of their practice. Thirdly, teachers found concept maps a valuable way of documenting consensus amongst peers and for summarising the requirements of syllabus documents. Most importantly, in the context of a new strategy, collaboration, sharing knowledge and documentation were modelled by teachers in a way that provided them with the confidence to introduce concept mapping into their classes. Engaging in opportunities for sharing knowledge and working towards consensus amongst a group of peers encouraged teachers to introduce new strategies into the classroom. This readiness to become learners and to apply acquired knowledge reflects important characteristics of an effective community of learners identified by Black and Wiliam (2007). Some comments taken from the teachers' reflection sessions qualify these points:

> *To make them (concept maps) relevant, you need to ensure that you begin them at the right level.*
>
> *I'm beginning to see their applicability more when working collaboratively with teachers – to keep them aware of language difficulties etc.*
>
> *I feel that concept maps are a great tool for planning – for working out what the key concepts are and for knowing where you are wanting to head with the unit.*
>
> *Concept maps are a great way to organise your ideas.*

Finally, three characteristics of exemplary practice that are detailed in the professional standards for mathematics and science teachers were listed in the Introduction to this paper (AAMT, 2007; ASTA, 2007). Teachers who took part in the study indicated that the professional development activities based around the implementation of concept maps supported those characteristics, thus providing an informed basis for further work in these areas. The three characteristics and illustrative quotes from participants are repeated below. Teachers:

- Engage in professional development that are collegial: *We realised the importance of collaborative work and that working as part of a team could give more satisfaction;*
- Actively explore new teaching ideas: *It helps to be able to break the information to be taught into little pieces;* and
- Initiate purposeful dialogue with students about their subject: *Concept maps are helpful for students to organise their learning.*

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ABSTRACTS

Abstracts–Keynote Speakers

What Works Best and What Evidence Assists for Narrowing the Gap and Addressing Educational Disadvantage

John Hattie
The University of Auckland
Thursday – 26 April 2007 in Room 111

There are so many solutions in education for 'narrowing the gap'. What is needed is an evidence base about 'What Works Best'. This session will outline a model of teaching and learning based on 700+ meta-analyses, and then lead into practical solutions for teachers and schools based on these findings. The solution has been implemented in 1000+ NZ schools. The key concepts involve teachers' conceptions of learning and progression, the power of feedback, and multiple notions of achievement.

Squandering Cognitive Capacity on an International Scale

James M. Royer
University of Massachusetts, Amherst
Thursday – 26 April in Room 111

This address will highlight the critical role that efficient use of cognitive capacity (working memory) plays in academic achievement. The address will begin with a brief overview of the human cognitive system followed by an explanation of how cognitive capacity can be used more efficiently by learning to do some things without thinking about them. It will be pointed out that low-level aspects of academic skills such as reading, writing, and mathematics can become automatic and that virtually all higher-level academic learning is dependent on automated low-level skills. The address will then turn to a discussion of three factors that block the development of automated cognitive skills. The first is associated with individual differences in capacity itself and in individual functional capabilities such as those associated with dyslexia and dyscalculia. The second factor is associated with variation in world languages. As will be seen, it is much easier to attain early automaticity of low level reading and math skills in some languages than it is in others. The third, and most important factor from the view of the author, is associated with poor instructional practices. Evidence ranging from studies of effective instructional practices for students with dyslexia to international studies of literacy instruction in developing countries will be presented to support the argument that an enormous amount of world wide cognitive capacity is being squandered because of poor instructional practices.

Realising the Promise of Education in the 21st Century

Geoff Masters
Australian Council for Educational Research
Friday 27 April 2007 in Room 111

Education is seen by society as a way of enhancing opportunities for *all:* the key to unlocking human potential; a way of escaping disadvantage; and the key to future economic prosperity. This paper focuses on two contemporary and related concerns in Australian education: (i) the significant proportion of young people who become disengaged during their school years, achieve only minimal educational outcomes and have limited subsequent engagement in work or further learning; and (ii) the shortage of young people with the knowledge and skills required for effective participation in the future Australian workforce. While education is a door to opportunity for some, it is failing to live up to its promise for many young people. Of even more concern is the suggestion that current education arrangements may actually be exacerbating inequalities and disadvantage. Could education be *closing* the door of opportunity for some young people?

The Principles of Engagement: Young Adults Talk about Recreational Reading

Adrian Ashman
The University of Queensland
Friday 27 April 2007 in Room 111

As we grow and experience life we learn about the processes involved in thinking. We learn to deal with incoming stimuli, integrate it with our existing knowledge base, use strategies we have developed to deal with thoughts and emotions, events, and behaviour, and to adapt our thinking and behaviour to suit the circumstances. When we are taught to read – or learn to read independently – we acquire a range of cognitive skills that enable us to become aware of the process of reading and more generally about ourselves. This paper explores this process of early reading acquisition.

This paper reports recent work by the author on readers' awareness of their own reading skills, knowledge, and awareness of the reading process (their metacognition). Two models are outlined. The first elaborates a general perspective on the recreational reading process. The second examines aspects of engagement that relate to the implicit conversation that occurs between the reader and the novelist. Engagement is a two-level dimension of reading. The first deals with the author's contribution and the second, the reader's response. During the presentation I will give brief excerpts from the qualitative data collected from 130 Year 10 through 12 students. Implications for student performance across the curriculum, both inside and outside school, are raised as a matter for continuing discussion among all stakeholders in the education process.

Facilitating Children's Early Literacy Development: The Issue of Sequencing Language and Decoding Strategies for Students from Disadvantaged Communities

Ian Hay
University of New England
Friday 27 April 2007 in Room 111

Language is considered vital to the development of children's social skills, cognitive abilities, and academic outcomes. The evidence is that language difficulties and learning difficulties have a significant negative impact on children's education and that there is a strong relationship between children's early language and phonological awareness/sensitivity and later reading and spelling development. This presentation supports the notion that there is a developmental continuum between young children's language skills and their later reading and comprehension skills. How to assess and enhance children's language skills and how language and communication skills interact with children's phonological development are the core issues of this presentation. As part of the presentation, strategies that have been developed, implemented and evaluated for a population of some 100 Year 1 children with poor language and phonological skills will be demonstrated and reported, along with an overview of the associated assessment procedures.

Narrowing the Gap with QuickSmart: Offering Students a New Chance to Acquire Basic Academic Skills

John Pegg and Lorraine Graham
SiMERR National Centre
University of New England
Saturday 28 April in Room 111

Australia is well recognised in terms of international test results (e.g. PISA and TIMSS) for the successes of its average and high-achieving students. Unfortunately, Australia is also known for the gap between the scores of these students and those of its poorest performers. There is no simple formula for improving the educational outcomes of low-achieving students. Many elements need to be in place including equitable social backgrounds, appropriate teaching strategies, encouraging and supportive learning environments, and willingness on the part of students to learn. Evidence shows that once students begin failing in school the likelihood of their educational success diminishes in comparison to their better-achieving peers. In educational terms the evidence confirms that over time the "poor" do indeed get "poorer". Breaking the cycle of failure for persistently low-achieving students has been one of the aims of the SiMERR National Centre since its inception. This aim has been addressed in part through the development and implementation of a research-based program of instruction referred to as *QuickSmart*. This intervention targets students who are consistently experiencing a lack of success with basic academic skills. *QuickSmart* aims to support these vulnerable students as they "narrow the gap" in terms of their basic mathematics skills or reading through an intensive educational intervention. This presentation details the *QuickSmart* program and its underlying theory and philosophy as it has been implemented in NSW and Northern Territory schools since 2001. *QuickSmart* offers low-achieving students a new, and possibly last, chance to acquire the basic skills necessary for them to be active, contributing members of their classrooms. The results of independent evaluations of the program as well as reflections from students, teachers and principals on why the program has been so successful are discussed.

Refereed Abstracts

Gaps in Preservice Teachers' Knowledge and Understanding of Primary Mathematics

Karoline Afamasaga-Fuata'i
SiMERR NSW
University of New England
Friday 27 April 2007 in Room 105

The presentation reports the results from the first longitudinal numeracy study that was established to monitor the development of primary preservice teachers' numeracy and mathematical competence levels during their teacher education program. Student responses from the first Mathematics Diagnostic Test (MDT1) are analysed using the Dichotomous Rasch Measurement Model to determine a hierarchical, cognitive development framework underpinning the items in the diagnostic test. A conceptual analysis of student errors enabled the identification of students' initial misconceptions. The framework highlighted key areas of difficulties and gaps in preservice teachers' mathematics knowledge, which require urgent remediation before exit. Main findings suggest that preservice teachers find solving word problems the most difficult followed by items on reasoning and operating with fractions and probability while the basic geometric, algebraic and numeric computation items were the easiest. These have implications for teaching mathematics in primary schools if the prevailing problem with basic numeracy and literacy skills is to be effectively addressed.

Narrowing the Gap: From Documents to Doing Using Concept Maps

Karoline Afamasaga-Fuata'i[1] and Greg McPhan[2]
SiMERR NSW, University of New England[1] and
SiMERR National Centre, University of New England[2]
Thursday 26 April 2007 in Room 105

The focus of this presentation is the support of student learning as it relates to the conference theme of collaboration between researchers, teachers and support teachers. A working definition of the title has been adopted as follows. The 'gap' referred to relates to the separation which can exist between the intent of syllabus documents or prepared learning tasks and the reality of classroom practice. It also relates to the gaps which can exist between students' conceptions of the purposes of learning tasks. 'Narrowing' the separation is achieved by classroom teachers as they manage, interpret and plan material for classroom use.

This session will present an overview of some teacher professional development activities for teachers of mathematics and science that took place during an Australian Schools Innovation in Science, Technology and Mathematics (ASISTM–Round 1) project in 2005-06. During the project, teachers from primary, secondary and learning support areas worked collaboratively using concept maps as advance organisers for relevant sections of syllabuses and learning material to be used in the classroom. As part of the planning activity, teachers were able to identify appropriate teaching and learning sequences, essential background information for problem solving and potential problem areas that students might encounter. These three areas are critical elements in supporting student learning. In addition, the advance organiser documentation which was developed as part of each exercise can form the basis of a novel means for tracking student learning in the classroom.

Narrowing the Gap in the Regular Classroom: Successful Strategies for Teaching and Learning in the Middle-School Years

Anne Bellert
Catholic Education Office, New South Wales
Friday – 27 April 2007 in Room 106

This seminar focuses on the educational disadvantage experienced by middle years students with learning difficulties and at times has a specific focus on those students living in rural and regional areas of Australia. Students in the middle school years who face challenges with learning are repeatedly disadvantaged, yet the planned efforts of a well-informed teacher can make a great contribution to overcoming obstacles to successful learning faced by these vulnerable students. The seminar begins with a brief, literature-based review of the concept of learning difficulties and then goes on to identify 'factors of disadvantage' commonly experienced by middle years students with learning difficulties, particularly inefficiencies in cognitive processes and negative motivational and self-concept beliefs. This information is then bought together into a proactive framework which links the 'factors of disadvantage' with strategies for overcoming these obstacles. Based on the understanding that teachers have great potential for 'narrowing the gap' in performance and participation of students with learning difficulties, the framework features evidence-based adjustments in literacy and content area learning that can be readily implemented by classroom teachers.

Tape Assisted Reading to Support Students Literacy in Two Bilingual Schools

Mere Berryman[1], Paul Woller[2] and Ted Glynn[2]
Ministry of Education, Poutama Pounamu Education Research and Development Centre[1] and University of Waikato[2]
Thursday – 26 April 2007 in Room 104

In 2006 a collaborative literacy project evaluated the effectiveness of a tape-assisted reading resource for students learning to read in Māori in two New Zealand bilingual schools.

The tape-assisted reading resource consists of 100 Māori-language reading texts at five increasing levels of difficulty, read on to tape. Two different comprehension activities, kupu whakauru (cloze cards) and puawaitanga (three level guide cards) were developed for each taped story. Comprehension cards were used by the teacher to monitor students' understanding of texts and by the students to ensure they had opportunities to practice talking about the stories they had read. Each student was supplied with a recording book to track the stories and activities they had read at each of the Ngā Kete Kōrero reading levels, and a walkman tape for individual listening.

One of these schools maintained the program in the school while the other school encouraged students to use the resources at school as well as in their homes. This paper presents the findings of this trial from each of these two schools.

Akoranga Whakarei: Enhancing Effective Practice in Special Education for Māori Students

Mere Berryman[1], Tracy Togo[1], Paul Woller[1] and Ted Glynn[2]
Ministry of Education, Poutama Pounamu Education Research and Development Centre[1]
and University of Waikato[2]
Friday – 27 April 2007 in Room 104

The Enhancing Effective Practice in Special Education (EEPiSE) project was part of a broader New Zealand Ministry of Education policy initiative to support and develop teachers' ability to provide learning opportunities for all learners. Specifically, the project aimed to develop teacher knowledge and share ideas on how to support learners who require significant adaptation to the curriculum.

This paper involves eight schools in which Māori students were in the main, the majority school population. In 2004, four Māori medium schools worked in collaboration with researchers to identify effective practices for students who they identified as having special needs. The following year one of the existing schools and another three new schools sought to introduce new practices in order to strengthen their own curriculum adaptation practices. Collaboratively teachers reflected on their work as it evolved and evaluated their results. This paper involves a retrospective examination of the qualities of professional learning required by staff in order to sustain and enhance ongoing learning for these students.

What You Expect is What You Get: The Impact of Mathematics Teachers' Beliefs About Students' Capacities on Their Practice

Kim Beswick
SIMERR Tasmania
University of Tasmania
Thursday – 26 April 2007 in Room 105

This paper draws together evidence obtained from several research projects conducted principally in Tasmania but also in the UK concerning the impact on teaching of differentiated teacher expectations of students' capabilities. Questionnaire data indicate that teachers hold different views about appropriate curricula and goals of mathematics teaching for different groups of students depending on their perceptions of the students' abilities, while interviews and observations illustrate the ways in which differing teacher expectations are played out in classrooms.

Rather than suggesting simplistic or causal links between teachers' beliefs and practices, the paper draws on nuanced understandings of the content and structure of teachers' belief systems. In particular, evidence of the mediating effects of teachers' beliefs about the relative compliance of students perceived to be of differing abilities on teachers' pedagogical choices is considered. Implications for students' opportunities to achieve in the context of the explicitly or implicitly differentiated curricula that result from teachers' beliefs about them are also examined.

The evidence illustrates that improvements in the mathematics achievement of relatively disadvantaged groups of students is dependent upon teachers believing that more is possible. With this in mind the characteristics of two approaches to encouraging desired change are also considered. One of these is a professional learning model instigated by researchers and the other driven by a head of department within a school.

The paper will be framed by current understandings of the content and structure of mathematics teachers' belief systems and of effective professional learning for teachers.

Lessons From an Initial Trial of a Mathematics Software Package in a Rural Secondary School

Kim Beswick[1] and Simon Browning[2]
SIMERR Tasmania, University of Tasmania[1] and Tasmanian Department of Education[2]
Friday 27 April 2007 in Room 105

This paper reports on a brief trial of the Mathspower program with students in a relatively remote rural Tasmanian secondary school. The program was offered to 73 students in Grade 10 as an additional resource for use at home. Forty-four students opted to take a copy of the program but many reported using it very little or not at all. Those who did use the resource were positive about its value.

The software was also used in class with a small group of students with learning difficulties. The results from this very small scale intervention suggest that the program has potential as a resource for teachers catering with diverse student groups and points to the importance of the teacher in facilitating students' interaction with the program.

The attitudes to mathematics of all of the students in the Grade 10 cohort as well as their achievement in the subject are reported along with possible reasons for the failure of the software program to engage most students and hence to make significant differences to either attitudinal or achievement outcomes. The study provided valuable insights into the difficulties faced by teachers attempting to motivate students with a view to improving their mathematics outcomes and offers salutary lessons about maximising the effectiveness of interventions.

The paper will make links to relevant literature concerning student motivation and educational aspirations including those reported in the National Survey conducted by SiMERR.

Technology and Teachers in Rural Schools: Diversity and Similarity

Gail Chittleborough, Coral Campbell,
Peter Hubber and Russell Tytler
SiMERR Victoria, Deakin University
Thursday – 26 April 2007 in Room 105

This paper reports on a project situated in regional areas of Victoria in which 16 primary and secondary teachers participated in an intensive program of professional development designed to assist them in embedding ICT into their classroom practice. The project provides some insight into the availability and use of current technological resources in rural schools and examines the impact of an intensive professional development program on the implementation of ICT into the curriculum.

The results identified a large diversity of circumstances experienced by the schools in the project, not only in terms of ICT availability and use, and teacher experience, but also in more general issues of cultures of curriculum planning and integration, size, communication, and pedagogical presumptions. The successful integration of ICT into pedagogical practice was influenced by a complex set of factors including the availability of ICT resources, teachers' ICT skill level, teachers' abilities and opportunities to integrate ICT in classrooms, the level of support provided, both technical and pedagogical, and curriculum requirements.

The results of the project have been positive with evidence of increased networking among teachers, changes in teaching practice and increased teacher proficiency and awareness of ICT resources. The project has highlighted common difficulties that teachers experienced including frustrations with the unreliability of technology and a lack of time for necessary training and preparation. In response to the constraints, teachers have been resourceful and inventive in developing pedagogical strategies to aid the integration of ICT into their classroom practice.

Aboriginal Summer School for Excellence in Technology and Science

Julie Clark
SiMERR South Australia
Flinders University
Friday 26 April 2007 in Room 104

This paper will describe the ASSETS program, Aboriginal Summer School for Excellence in Technology and Science, which was run annually for 10 years in Adelaide under the auspices of the Faculty of Aboriginal and Islander Studies of the University of South Australia. SiMERR SA, in conjunction with the SiMERR National Centre would like to re-establish a new program of summer schools based on the model of ASSETS. The main aims of ASSETS are to:

1. Provide a unique academic and culturally enriching experience for Indigenous children;
2. Help support cohorts of Indigenous children to succeed at high school and university;
3. Celebrate excellence of potential and performance of Indigenous children; and
4. Positively impact on Indigenous students' access to careers in the sciences.

The students who participate will have aptitude and interest in science, ICT and mathematics. They will be moving into Year 11 programs with significant emphasis in these areas. The program for ASSETS Mark 2 will have strong academic and cultural components. The academic program will feature collaborative, project-based learning that involves interaction with experts in the field. The cultural program will involve interaction with elders and role models that enables personal growth and the development of the leadership capabilities of Indigenous young people.

Cracking Open Text Books in the Middle years

Leone Coorey and Joyce Stark
Catholic Education, South Australia
Thursday – 26 April 2007 in Room 106

Indigenous students with learning difficulties in the middle years of schooling, are often confronted by text books in a range of curriculum areas that have a readability level which is so far above students' independent reading ages, that the texts are, in essence, inaccessible. Following a discussion of an analysis of some middle school texts, an ideal learning environment will be outlined that combines Productive Pedagogies within the context of the constructivist approach underpinning the South Australian Curriculum Standards and Accountability (SACSA) Framework.

In South Australia, text books are commonly utilised in the middle school years to provide topic based information for students and to pose some questions to test student learning. While the information in the text may be accessible to some students, in the new millennium, in the age of information, is it relevant to be limiting student focus to a teacher selected text? For students with difficulties in reading, opportunities to access and explore their world and worlds imagined, require the use of a wide range of sources and experiences in a self-directed and success-oriented environment. The possibility of achievement for all students is arguably not supported by the use of text books alone.

Self-evaluation which reflects the teacher's understanding of student learning, with an emphasis on learning not teaching, empowers effective programming for students, optimising engagement levels and resulting in significant improvements in student learning outcomes. Strategies for all teachers within the school and for students will be woven through the discussion, in order to provide suggestions of ways to support marginalised students who learn differently within an inclusive learning environment.

Narrowing the Gap: Empowering Teachers and Parents Through Understanding how Children with DS Develop Mathematically

Rhonda Faragher[1], Jo Brady[1], Barbara Clarke[2], Doug Clarke[3] and Ann Gervasoni[3]
SiMERR ACT, Australian Catholic University National[1], Monash University[2] and Australian Catholic University National[3]
Friday 27 April 2007 in Room 105

Children with Down syndrome can and do learn mathematics. However, little is known of the process of development of important concepts that underpin their lifelong numeracy. Research evidence is limited largely to the number strand (Bird & Buckley, 2001), and has almost always been collected in large cities. A research study based at SiMERR ACT aims to improve the numeracy education outcomes of children with Down syndrome in regional areas by tracking over one year mathematical development of 36 children of ages 6, 8 and 10. By involving families in regional areas to complement data collected in metropolitan centres, the research team aims to determine the variables involved for families and teachers in regional areas.

This paper presents the scope of the research and reports results of the pilot stage, which involved developing an appropriate instrument to measure mathematical development. The successful Early Numeracy Interview from the Early Numeracy Research Project (Clarke et al, 2002) served as the basis for adaptation. The interview has been used extensively and with some children in special education settings, however, children with Down syndrome appear not to have undertaken the interview prior to this study.

Piloting the interview identified a number of issues in the development of a useful instrument for the project. Account had to be taken for learning differences (Wishart, 1996) and to determine if the developmental sequence for children with Down syndrome is delayed or different from that of other children. Finally, the modified interview emphasises areas such as space and measurement, seeking to redress the overemphasis on number in extant research.

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The Wii Gaay Project: Gifted Aboriginal Students

Peter Merrotsy
SiMERR NSW
University of New England
Friday – 27 April 2007 in Room 106

The Wii Gaay Project aims to identify intellectually gifted Australian Indigenous children and to provide suitable provision that will enable them to attain their potential within the education system.

Historically, the identification of gifted children coming from a background of disadvantage, including socio-economic disadvantage and cultural minority status, has proven to be quite difficult. The Wii Gaay Project has adopted the Chaffey (2002) Coolabah Dynamic Assessment tool in order to identify gifted Indigenous students, who include gifted underachieving students (students previously identified to have high learning potential) and "invisible" gifted underachieving students (students not previously identified to have high learning potential). The assessment seeks to optimise cognitive performance by overcoming perceived sources of academic underachievement, which include low self-efficacy and low teacher expectations.

This paper presents the initial findings of the project, and discusses the implications for educators. Coolabah Dynamic Assessment appears to be very effective in identifying underachieving gifted Aboriginal children, in particular invisible underachievers. Children involved in the Wii Gaay project over two years show modest academic gains, enormous gains in school participation and engagement in class activities, and enormous affective gains. However, it would seem that the attitudes and expectations of the teachers are slow to change, though some teachers do adjust their classroom practice, have a positive and supportive attitude towards their students, and have higher expectations of them.

Adaptive Help-seeking as a Means of Narrowing the Gap for Students with Disabilities: A Pilot Study

David Paterson
SiMERR NSW
University of New England
Thursday – 26 April 2007 in Room 106

Increasingly, students with disabilities are being educated in regular classrooms. Evidence for a decrease in the gap between their academic achievement and that of their peers, however, is limited (Shevlin, 2003). Much of the research investigating ways of narrowing this gap has been focussed on the use of support personnel and associated resource implications. An alternative area of investigation is the way that students with disabilities seek help in classrooms. It is argued that by understanding how this occurs, teachers may be better able to facilitate the development of self-regulating learners, learners who are less dependent on external resources for effective learning.

This paper describes a study which explored the strategy use of four secondary students with intellectual disabilities, specifically strategies related to adaptive help-seeking (Newman, 2002). In this study, the extent to which these students used adaptive help-seeking strategies in inclusive classroom contexts was considered with a view to identifying instructional approaches which might assist in narrowing the gap between the achievement of students with and without disabilities in regular classrooms.

Using non-participant observation and semi-structured interviews with teachers and students, this pilot study indicated that students with disabilities were sensitive to the characteristics of the teacher, were able to describe conditions under which effective help would be provided and often made use of peers for help with academic tasks. While teachers frequently invited students to ask for help, explicit instruction in adaptive help-seeking strategies did not occur.

SYMPOSIUM
Addressing Aboriginal Cultural Knowledge: Partnerships, Professional Learning and Possibilities

Frances Plummer[1], Kerin Wood[1], Lois Birk[2], Jessica Birk[3] and Wendy Hanlen[4]
NSW Department of Education and Training[1], Royal Far West School[2], Stewart House[3], and University of Newcastle[4]
Thursday – 26 April in Room 104

Preparation for teachers to address Aboriginal cultural knowledge through the school curriculum has relied on teachers' personal histories, experiences and assumptions. Only recently have most newly appointed teachers had access to formal training in Aboriginal education. The challenges, in schools where the significance of addressing Aboriginal cultural knowledge is paramount, are heightened by short-term appointments where teachers do not know the Aboriginal families from which students come and who are unfamiliar with the local sensitivities from past injustices that resulted in trust not readily given to non-Aboriginal teachers.

This presentation describes how an Australian Government funded activity is implementing a professional development model to build school and community capacity in twenty-one schools with 10%-20% of each school's population being Aboriginal students. Partnerships with local Aboriginal community members have a powerful effect on teachers' capacity to understand, value and respect the impact of Aboriginal cultural knowledge in their teaching. The presentation will outline how working in partnership with the Aboriginal community and investing in professional learning as the agent for change have demonstrated that it is the teacher who makes the difference to how Aboriginal cultural knowledge is integrated into the curriculum. External support from an academic partner and project officer make up the other elements in the model of professional development described.

In this presentation, the model, actions and results of implementing a strategy designed to improve teachers' capacity to address Aboriginal cultural knowledge and to improve the quality of students' learning experiences are discussed. School stories will be highlighted as examples of the professional learning strategy in action.

C^3: Concepts, Content, Context: An Approach to the Professional Development of Teachers of Mathematics

Ian Roberts[1] and Helen Spiers[2]
SiMERR NT, Charles Darwin University[1] and
Charles Darwin University[2]
Saturday 28 April 2007 in Room 105

Mathematics is an integral part of a rich cultural experience, and the art of teaching mathematics involves a sound understanding of the discipline.

The Northern Territory has been characterised by high rates of teacher turnover, remote schools, and limited training of teachers of mathematics in mathematics. The NT has a detailed curriculum framework requiring sophistication to interpret appropriately for classroom practice.

There are several UNE projects running in the NT to support student learning including *QuickSmart* and SOLO. Their predominant focus is motivated by theoretical and practical aspects of the science of learning at a micro-level.

The C^3 project has a macro-level approach (mathematical concepts providing a structured framework) and is intended to complement the other projects. It was trialled in 2006 to provide support to teachers of Years 5 to 7. It addressed the major issue of teacher competence and confidence in the teaching of mathematics – their self-efficacy. Teaching is greatly enhanced by engendering confidence and enthusiasm in teachers based upon a genuine love and appreciation of the subject. This is expected to provide a catalyst to providing a similar motivating experience for school students.

The C^3 project is motivated by the many mature-age students now being trained as teachers who often have a negative attitude to mathematics and lack the basic craft skills of the discipline. These teachers are not prepared for encompassing the art of teaching mathematics nor implementing the science of learning.

A report on the project, its philosophy, and outcomes will be presented, along with current and planned future directions.

Dynamic Differentiation for Student Diversity in Inclusive Classroom Ecosystems

Susen Smith
University of New England
Friday 27 April 2007 in Room 106

Many models have been developed to represent different teaching, learning and developmental processes and contexts. These models are supported by philosophical views. The systems view is holistic and reflects unique individuality within complex relationships, where teaching and learning is interconnected, dynamic, flexible, and creative (Bronfenbrenner, 2005; Huitt, 2003). Such models provide the organisational framework around which empirical data can be arranged, interpreted, illustrated or viewed concurrently, but systematically, and as a cumulative inter-relational whole (Bronfenbrenner, 2005).

Classroom instruction is complex but linked by broad similarities, such as the variety of instructional techniques and materials used (Pressley, Wharton-McDonald, Mistretta-Hampston & Echevarria, 1998). Researchers have identified the interconnectedness of factors that contribute to student learning outcomes, including aptitude, environment, instructional quality and engagement (Fraser, 1998). These interconnected factors suggest dynamic relationships between teaching and learning (Chessman, 2003; Comber et al., 2002).

This presentation links a philosophical view with literature on dynamically differentiating literacy instruction for student diversity in inclusive classrooms (Bronfenbrenner, 2005; Tomlinson et al. 2002). In this context, diversity relates to students with varying reading capacities. Factors related to instructional differentiation include student diversity in inclusive settings, instructional ecology, the instructional cycle, academic engagement and the dynamics of teaching and learning for individual student needs (Conway, Arthur-Kelly & Pascoe, 2004; Tomlinson et al. 2002). A schema was developed through an extensive literature review, survey, observation and case study data from PhD research in New South Wales primary schools. The schema represents various practical methods of differentiating instruction for student diversity visually.

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Children with Special Education Needs in Mainstream Classrooms: Implications for Inclusive Pedagogy from a Systematic Review of the Literature

Janice Wearmouth[1] and Melanie Nind[2]
Victoria University of Wellington[1] and University of Southampton[2]
Saturday 28 April 2007 in Room 106

Policy-makers often advocate inclusive education without an awareness and understanding of the pedagogical approaches that teachers can use to put the policy into operation (Mittler, 2000, Nind & Wearmouth, 2004). This paper reports the outcomes of the first of a series of three systematic literature reviews whose aims were to:

- Establish what research has been undertaken in the area of effective pedagogical approaches for including children with special educational needs in mainstream classrooms;
- Synthesise the findings of research studies identified as both valid and reliable; and
- Examine how this research might inform practice.

We outline some of the features of teaching approaches shown to lead to positive outcomes in academic attainment, social involvement and improved behaviour. However, reviewing the literature gives teachers evidence-related ideas to work with, not a recipe to follow (McNiff, 1993). Effective teaching for inclusion is complex (Alton-Lee, 2003). We discuss how teachers and teacher educators might use the evidence as part of classroom-based research or reflective practice (Elliot, 2004).

According to the evidence reviewed here, inclusive teaching approaches cannot be reduced to simplistic formulae, but rather bring together teacher skills with a willingness and ability also to make use of student skills. This implies the need to see all learners, including teachers, as having active agency in learning and, therefore, to acknowledge the importance of the teacher as a reflective practitioner (Schön, 1987) and the school itself as a site of reflective practice.

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Abstract: Using Assistive Technologies to Bridge the Tyranny of Distance in University Courses

Stephen Winn
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Friday 27 April 2007 in Room 104

This paper examines the use of interactive video conferencing, the use of Blackboard, audio-visual resources with print resources to enable tertiary students located in rural and regional parts of Queensland, Australia, to enrol in a series of post-graduate courses. The uniqueness of these courses was that they were about Australian Sign language (Auslan) which is a recognised community language visually communicated with no written component. The students involved were mainly teachers from regional Queensland who worked with children with impaired hearing or who were deaf and used a visual means of communication. Some of the students had little or no experience with Auslan apart from contact with deaf adults in their community.

The course utilized a range of technologies including interactive video conferences for a one-hour lecture a week and a one-hour tutorial. In addition on-line activities, resources, lecture notes, tutorial and workshop activities were provided. Students were required to have internet access, typically broadband, and had to undertake a range of timed on-line assessments. Forty students were enrolled in these courses.

This paper details the issues and strengths of delivering a visual language via ITC and highlights how such technology can bridge the gap of distance, access, and engagement for those students in rural parts of Australia. As a mode of delivery the use of combined technologies with in-person tutorials has the potential to engage students in learning where typically residential schools and other forms of delivery may have been utilized.

SYMPOSIUM
Addressing Education Debt: Narrowing the Disparities Between Dominant Culture and Indigenous Children

Russell Bishop[1], Mere Berryman[2], Lani Teddy[1] and Tom Cavanagh[1]
University of Waikato[1]and Ministry of Education Poutama Pounamu Education Research and Development Centre[2]

Friday 27 April 2007 in Room 104

Results from the PISA (Program for International Student Assessment) 2000 study reveal that schools in New Zealand, Australia, and the United States of America provide education that is of high quality but at the same time of low equity. This means that while the quality of education in these countries is high, not all children are benefiting at the same level from attending school (OECD, 2001).

This symposium will address more effective responses to the education debt (Ladson-Billings, 2006) resulting from on-going years of disparity for one group of students – Indigenous children. This group includes Māori students in New Zealand, Aboriginal students in Australia, and Native American students in the United States.

Researchers from the University of Waikato in Hamilton New Zealand and the Ministry of Education will share the results of their work carried out over the past five years on a project called Te Kotahitanga. This project focuses on raising the achievement of Maori students in New Zealand secondary schools. This symposium consists of four papers: (a) creating a

culturally responsive pedagogy of relations, (b) implementing a professional development initiative to incorporate a culturally responsive pedagogy of relations in classrooms, (c) listening to the voices of Indigenous children about their education, and (d) using research to support an Indigenous worldview of education.

This symposium examines a kaupapa Māori solution to the educational crisis that is currently facing Māori students in mainstream educational settings in a way that connects politics, pedagogy, action and critical reflection. Te Kotahitanga is a research/professional development project that aims to improve the educational achievement of Māori students in New Zealand by operationalising Māori people's cultural aspirations for self-determination within non-dominating relations of interdependence. In this sense, the project is informed by a kaupapa Māori theory of self-determination.

Symposium – Paper One

Implementing a Professional Development Initiative to Incorporate a Culturally Responsive Pedagogy of Relations in Classrooms

Mere Berryman[1] and Robbie Lamont[2]
Ministry of Education, Poutama Pounamu Education Research and Development Centre[1] and University of Waikato[2]
Friday 27 April 2007 in Room 104

The implementation of a professional development initiative to incorporate a culturally responsive pedagogy of relations in classrooms was based on the Effective Teaching Profile (ETP) that evolved out of the narratives of Māori students' experiences. This profile provided understandings and practices that enabled Māori students to achieve more successfully in mainstream classes.

Facilitators, all of whom were experienced teachers, were trained to work with teachers to implement the ETP in their classrooms. In so doing teachers were able to create a culturally appropriate and responsive context for learning through the development of a pedagogy of relations. Facilitators were trained to undertake four major professional development activities with teachers.

Initially teachers learned about the kaupapa or underlying philosophy of the project. They learned about the ETP and the cycle of related professional development activities. Teachers then returned to school and engaged with facilitators in a series of in-class professional development episodes that were implemented in each term of the school year. This process consisted of classroom observations, interactive feedback sessions on lessons observed, collaborative co-construction meetings followed by further in-class support in the form of shadow-coaching, all conducted by the trained facilitators. The regular (four times a year) formal observations provided details of classroom interactions, student engagement and work completion, teacher and student locations within the classroom, the cognitive level of lessons and details of the relational elements of the ETP.

Following the in-class activities, the facilitator conducted an interactive co-construction meeting with a group of teachers who were associated with a target class but who came from across different curriculum areas. Co-construction meetings involved facilitated opportunities for teachers to collaboratively and critically reflect on a range of Māori students' participation and achievement data and set goals for sustaining or developing further improvements. This was then followed by further in-class observations in the form of shadow-coaching, which involved in-class support and feedback on the lessons, the strategies or the approaches that were developed in the co-construction meetings. This process helped teachers to develop professional learning communities focused on improving Māori student achievement.

Symposium Paper Two

Creating a Culturally Responsive Pedagogy of Relations

Russell Bishop
University of Waikato
Friday 27 April 2007 in Room 104

Like other indigenous students, many Māori students suffer from social and educational disparities. A kaupapa Māori educational research theory was developed (Bishop, 2005; Bishop & Glynn, 1999) as one response to these disparities. From this theory, a culturally responsive pedagogy of relations emerged (Bishop, Berryman, Cavanagh & Walker, 2006).

Te Kotahitanga commenced in 2001 with the gathering of narratives of Māori students' classroom experiences by the process of collaborative storying (Bishop, 1996). The project sought to understand the self-determination of Māori secondary school students by talking with them and with other participants in their education settings about just what was involved in limiting and/or improving their educational achievement (Bishop & Berryman, 2006). From these narratives of experience, researchers developed an Effective Teaching Profile (ETP), which identified understandings and practices that would enable educators to more effectively support Māori students to achieve to their potential in mainstream classrooms. Researchers then sought to implement this ETP by training teachers to create culturally appropriate and responsive contexts for learning in classrooms, through the development of a pedagogy of relations.

The students were clear about what would work. By placing the self-determination of Māori students at the centre of classroom relationships and interactions, teachers could change how they traditionally related and interacted with Māori students in their classrooms and thus could create a context for learning wherein Māori students' educational achievement could improve. It was from the ideas of those who were positioned within the discourse of agentic relationships that the ETP was developed. This profile puts at centre stage the necessity for a common kaupapa or philosophy that rejects deficit thinking and pathologising practices (Shields, et al., 2005) as a means of explaining Māori students' educational achievement. In concert is the underlying aspiration for rangatiratanga (self-determination) that promotes the agency of teachers to voice their professional commitment, willingness to engage in whānau relations and interactions and reciprocal practices that are fundamental to addressing and promoting educational achievement for Māori students.

Symposium Paper Three

Using Research to Support an Indigenous Worldview of Education

Tom Cavanagh
University of Waikato
Friday 27 April 2007 in Room 104

Research for Te Kotahitanga was based on a kaupapa Māori educational research model (Bishop, 2005; Bishop & Glynn, 1999). The purpose of the research was to support the kaupapa or underlying philosophy and purpose of raising Māori students' achievement.

Using multiple indicators (Guskey & Sparks, 1996) we were able to show that when Te Kotahitanga teachers improved in their implementation of the Effective Teaching profile (ETP), their classroom learning contexts changed and Māori students improved in numeracy and literacy achievement. Based on these results we are confident that while teachers demonstrated significant shifts in their practice, Māori students have shown significant gains in their literacy and numeracy achievement scores. While other variables affected this outcome, we believe the evidence supports the conclusion that teacher involvement in Te Kotahitanga did contribute substantially to improvement in Māori students' literacy and numeracy achievement.

These results show that within a relatively short period of time, teachers were able to challenge and shift their traditional positioning vis-a-vis Māori students and shift their teaching practices, and we saw in association with these changes, improvements in Māori students' educational performance across a wide range of measures, including improving student achievement on standardised tests.

These changes in teacher understandings and behaviour meant that teachers changed their relationships and interactions with Māori students in a number of ways. Teachers formed closer relationships with Māori students, raised their behavioural and learning expectations of Māori students, changed the range of classroom interactions from traditional to discursive and interacted in more meaningfully ways by engaging more closely with Māori students' prior experiences as a basis for new learning. These interactions resulted in less negative student behaviour with more students wanting to learn and learning how to learn. Teachers also learned how student achievement could inform their ongoing practice. In association with these changes, Māori students became more academically engaged, completed more work in class, attended class more regularly and saw their summative assessment scores improve.

Symposium Paper Four

Listening to the Voices of Indigenous Children About Their Education

Lani Teddy
University of Waikato
Friday 27 April 2007 in Room 104

Just as the narratives of Māori students formed the basis of Te Kotahitanga and particularly the Effective Teaching Profile (ETP), their voices were the most important indicator about how effective the project was for these students. In the initial Phase 1 narratives, Māori students talked about the things that would engage them in education. They emphasised how problematic it was to be Māori in mainstream education. They indicated that teachers' rejection of deficit theorising about things Māori was essential to the development of respectful and caring relationships between Māori students and teachers. They yearned for positive recognition and acceptance of their own culture.

In the Phase 2 interviews, Māori students reported positively on their experiences in the classrooms with teachers participating in Te Kotahitanga. The students interviewed at this time commented on the benefits of good relationships with their teachers. These students reported that being Māori in the classroom was about being treated well by teachers, challenged in terms of their learning and listened to as individuals.

Students in Phase 3 strongly affirmed the importance of their teachers' theoretical positioning and the development of mutually respectful, caring relationships, if participation and learning was to follow. What was also evident was that as Māori students began to feel more secure in themselves and with their teachers, they could get on with learning and be far less concerned about the cultural manifestations of their identity. The students were certain that teachers being responsive to them as Māori and the way they were treated as Māori was essential; the quality of in-class relationships with teachers being paramount to their participation in the classroom. When their identity was secure the conversations of these Māori students focused largely upon being engaged with learning and thus better able to be self-determining, then and in the future.

Clearly, from these conversations, the ETP does indeed have real strengths for raising the achievement of Māori students. The professional development that these teachers received from their facilitators changed these teachers' approaches to teaching, making them exponents of the ETP and thus more effective practitioners for helping to raise Māori students' achievement.

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Implementation of the QuickSmart Program at Orara High School

Lyn Alder
NSW Department of Education

Friday 27 April 2007 in Room 106

Orara High is a comprehensive 7 – 12 PSFP funded public school located in Coffs Harbour on the Mid-North Coast. In 2005 when the school became a PSFP school it wanted to address the numeracy problems of Year 7 and Year 8 students. This presentation is a case study of Orara High and its implementation of the *QuickSmart* Numeracy Program from July 2005 to today. The program began with one learning support teacher and approximately 37% of Year 7 who did not meet the screening test benchmark in basic numeracy skills. The program expanded to include three teacher aides who provided *QuickSmart* instruction. This presentaton will describe Orara High School's implementaton of the *QuickSmart* Program during 2005 and 2006.

SYMPOSIUM
QuickSmart: Learning, Teaching and Reaching Middle school Students

Anne Bellert[1], Mary Walsh[2] and Lyn Alder[3]
Catholic Education Office, Lismore Diocese[1], Mary Help of Christians Primary School, Lismore Diocese[2] and NSW Department of Education Training[3]

Thursday – 26 April 2007 in Room 106

This presentation is a work-shop style practical session designed for classroom teachers and support teachers in the middle school years. The aim of the session is to provide participants with a review of some essential classroom strategies and approaches required to support improved learning outcomes for students with learning difficulties, with brief reference to the research base underpinning these approaches. The presenters are experienced practitioners from diverse educational settings, who have come together via collaboration on the *QuickSmart* program. The strategies they review support the development of basic academic skills. The session content relies on a close examination of selected teaching and learning approaches that are integral to the *QuickSmart* program but can also be beneficially applied in a wide variety of classroom learning situations. Timed practice activities, repeated reading, and instructional design to meet the needs of students with learning difficulties, are some of the key approaches to be explored. This presentation, with its focus on teacher behaviour to enhance student learning outcomes, encourages the implementation of an inclusive curriculum for students with learning difficulties.

Narrowing the Digital Gap

Tony Brown[1] and Mitchell Parkes[2]
SiMERR National Centre, University of New England[1] and SiMERR NSW,
University of New England[2]
Saturday 28 April 2007 in Room 105

Traditionally, the term 'Digital Divide' has been used to describe the technological divide between developed and developing countries, but as this narrows a new digital divide has been identified, that between adults (parents and teachers) and our children.

Learning about computer technology can be equated to learning a language. If a child learns a new language before they are about 12, they will be able to speak it without an accent, but if it is learnt later in life, it will be spoken with an accent. Young children who have grown up with technology as an integral part of their life are termed *Digital Natives* while their parents and teachers who encountered technology later in life are referred to as *Digital Immigrants* and have a 'digital' accent.

It has been argued that today's society leads to students retreating to their digital cocoon (bedroom) when returning home after school to an empty house and immersing themselves in a multimedia world. Further, it has been suggested that this constant exposure to multimedia day in day out for several years has resulted in the digital kids' brains being 'rewired' in the same way as it was when they learnt to read.

The result of this is that these digital kids learn in a different way to the way in which teachers teach. This presentation will look at the difference between students and teachers and consider some ways in which this gap can be narrowed.

QuickSmart Numeracy Pilot in the Northern Territory

Mike Caraher[1], Adam Spangler[1] and John Bradbury[2]
Anula Public School, Darwin[1] and Northern Territory Department of Education,
Employment andTraining[2]
Saturday 28 April 2007 in Room 104

In 2005 and 2006 the Northern Territory Department of Employment, Education and Training (NT DEET) ran a pilot program in some NT Top End schools to evaluate the effectiveness of the *QuickSmart* Numeracy Program. The trial targeted a range of schools situated in the Darwin/Palmerston urban region, rural/regional centres and remote bush schools. It included a variety of student populations from all Indigenous, to multicultural, ESL, and mainstream backgrounds.

The trial consisted of *QuickSmart* students who undertook the program and a comparison cohort who participated in the schools' normal Mathematics curriculum. Results gathered in 2005 showed some inconsistencies, therefore it was decided to repeat the trial in the same schools and extend the pilot to 2006. Initial data received for the 2006 trial has shown a majority of *QuickSmart* students have improved with basic number facts and times tables in both speed and accuracy matched with the comparison cohort. *QuickSmart* students also achieved better results on a written post-test.

The presentation will:

- Provide an overview of the schools selected for the pilot;
- Outline the essentials of the program;
- Detail how the pilot was conducted in trial schools;
- Present trial results for 2005 and 2006;
- Give a synopsis of a case study of the program at Anula PS; and
- As a conclusion outline the future directions and possibilities of *QuickSmart* in the NT.

Accelerated Literacy: Making a difference in the Northern Territory

Margaret Fenbury[1], Fiona McLoughlin[2] and Bill Begg[2]
Karama Primary School, NT[1,] and Northern Territory Department Employment, Education and Training[2]
Saturday 28 April 2007 in Room 106

The National Accelerated Literacy Program (NALP) aims to bridge the educational divide between Indigenous and non-Indigenous students in the Northern Territory by raising literacy levels using the Accelerated Literacy methodology. Literacy gains made by the student cohort to date have been significant and several key factors for sustained successful program delivery will be examined. The presenters – a principal, a teacher/data analyst and a professional learning manager - are all directly involved in the implementation, now in over 50 NT schools. The NT has committed to train 700 NT teachers to deliver the AL program to 10,000 students in 100 mostly remote schools by the end of 2008 and to develop strategies to systematise Accelerated Literacy as a sustainable teaching methodology.

The presenters will show how student assessment data provides an evidence base for teachers to reflect on their teaching and understanding of the methodology and how analysed data can be used by decision makers to identify individual and whole school future directions. As quality classroom practice is the key to improved student outcomes, the presenters will outline the essential features of the methodology and the associated professional learning pathway for teachers.

Choices made at the school leadership level are important for maximising the opportunities provided through Accelerated Literacy to build a culture of learning and high expectations for all students. The presenters will explore strategies for managing change and maintaining focus on the program, including developing a shared vision, managing human resources, building skill levels, implementing action plans, providing incentives and fostering a continual cycle of reflective practice.

Warren Central School – Connecting to Literacy Through Podcasting

William White
NSW Department of Education and Training
Thursday – 26 April 2007 in Room 104

The project will examine the use of podcasting as a new digital technology to enhance literacy development with Indigenous students in the middle school (Years 5 to 8). The project will encourage teachers to explore new pedagogical approaches related to the Significance and Quality Learning Environments of the NSW Quality Teaching framework. Special attention will be placed on elements of Cultural Knowledge, Connectedness, Explicit Quality Criteria and Engagement.

The project will support teachers' day-to-day classroom work in literacy, information and communication technology (ICT) and working with Indigenous students. Warren Central School has a strong desire to develop new and innovative teaching and learning practices to improve the literacy and technology outcomes of all students, particularly Indigenous students. Podcasting will allow teachers to involve students in building new literacies that require the integration of aural, oral, textual and multimodal communications; creating authentic learning experiences engaging students in real-world issues and situations as well as broadcasting their work to a public audience; developing cultural awareness and incorporating the cultural knowledge of Indigenous communities; enhancing motivation and self-esteem through risk-taking and having student ownership of the product; improving students' written and other communication skills; developing collaborative learning skills with students working in small groups to create their podcasts; and building generic learning skills including problem-solving skills, project management and organisational skills, planning skills as well as thinking and reasoning skills.

The project will run throughout 2007 with a possible extension into student-generated digital video in term four of 2007. The project team has enlisted the support of critical friends to support the school in the implementation and modification of the action plan. The evaluation of the project will be ongoing and a detailed analysis of teacher professional learning will take place at the conclusion. This will include what was achieved; what impact the learning project has had; what has been learned about teacher professional learning; future directions of the project and associated learning. A variety of strategies will be used including focus group discussions, learning logs, journals, portfolios, annotated student work samples and monthly meetings/video conferences with our academic partners.