Teaching for Growth

Effective teaching of literacy and numeracy

William Louden
Mary Rohl
Sarah Hopkins

Graduate School of Education
The University of Western Australia
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Bill Louden and Mary Rohl, Project Directors, May, 2008
EXECUTIVE SUMMARY

Teaching for Growth explored the relationship between children's growth in literacy and numeracy and teachers’ classroom teaching practices. It comprised two related studies: a study of teachers’ practices and children's growth in literacy in Pre-primary and Year 1; and a study of teachers’ practices and children's growth in numeracy in Year 8.

STUDY 1: GROWTH IN LITERACY IN PRE-PRIMARY AND YEAR 1

Analysis of the literacy assessments conducted at the beginning and end of Pre-primary and Year 1 revealed that:

- In Pre-primary, there was relatively little growth overall, particularly at the lower end of the achievement distribution, and a large amount of growth at the higher end.
- In Year 1, large amounts of growth were observed for all children, including low-performing children.
- Compared with a national sample of children in government schools assessed when they were approximately the same age with the same instrument in 1999, Western Australian children's performance was significantly lower. The gaps in performance were smaller at the end of Year 1 than they were at the beginning and end of Pre-primary and at the beginning of Year 1, but they were significantly lower at each assessment point.
- Average growth in Year 1 was approximately two and a half times greater than average growth in Pre-primary for WA children; average growth in the 1999 national sample was relatively similar in the Pre-primary year and Year 1.
- Western Australian Pre-primary children found all assessment items, particularly those concerning sight words, more difficult than children in the 1999 national sample. Average growth in the 1999 national sample was typically between two and three times greater than average growth in Pre-primary for WA children.
- Children's performance was significantly lower. The gaps in performance were smaller at the end of Year 1 than they were at the beginning and end of Pre-primary and at the beginning of Year 1, but they were significantly lower at each assessment point.
- There was a stronger focus on the development of oral language.
- There was a more systematic focus on explicit teaching of phonological awareness and phonics.
- Explanations at the syntactic (sentence) level were more frequent.
- Text-level discussions were more likely to involve higher-order thinking.
- Clear and substantive connections were more likely to be made between oral and written language.
- A wide variety of technical literacy-related vocabulary was more likely to be used.
- These teaching practices from the 'knowledge' dimension of CLOS-R were accompanied in the more effective teachers' classrooms by high levels of teaching practices from the other four CLOS-R dimensions, of 'respect', 'orchestration', 'support' and 'differentiation'. They were usually connected to a class theme or unit of work.

STUDY 2: GROWTH IN NUMERACY IN YEAR 8

The two year period between state-wide testing in numeracy achievement means that little can be inferred about the individual contribution a teacher makes to student learning based on differences in student performance over a single year. A similar statistical procedure used for estimating achievement gains in literacy (Study 1) was applied in Study 2 to estimate achievement gains in numeracy over a single year.

Numeracy achievement scores were collected for 2,864 students (132 classes) late in Year 8, using a modified WALNA numeracy test, and were matched with achievement scores from the Year 7 WALNA test results. Value added statistical procedures (similar to those used in Study 1) were applied to estimate students' achievement gains in numeracy, taking into account prior performance and student intake variables.
The results of the value added analysis were used to identify levels of effective teaching rather than levels of effective teachers. The distinction is an important one given the different context in Study 2, a secondary school setting. Many participating teachers were teaching more than one Year 8 maths class and the findings revealed considerable variance in estimates of student achievement gains between different classes of students taught by the same teacher. It was therefore more appropriate to use the term effective classes, or to suggest that students had benefitted from effective teaching, rather than suggest classes were taught by effective teachers.

The findings from the value added analysis showed that:

- All eleven of the highly effective classes were located in metropolitan schools, eight were in schools with SEI scores greater than 100, and ten classes had a Year 7 class mean above the grand mean for the study cohort.
- Three of the nine less than effective classes were in rural schools, only one was in a school with an SEI greater than 100 and none of the classes had a Year 7 class mean above the grand mean for the study cohort.

A subset of teachers was then approached to participate in the classroom observation phase of the study. A new instrument, the Teaching of Mathematics Observation Schedule (ToMOS) was developed for this purpose and pilot tested. The results indicated that:

- ToMOS is a reliable instrument for measuring teaching quality based on observed teaching practice, showing high levels of inter-rater reliability.
- There is a moderately strong relationship between ToMOS scores and student achievement gains.
- Further studies with a larger sample of teachers should be undertaken to confirm this promising result.

**Conclusions**

Study 1 and Study 2 have identified some important differences in rates of growth in literacy and numeracy. Rates of growth in literacy were slower for Western Australian Pre-primary children than for Year 1 children, but this was not the case for a national sample of children of similar age. Rates of growth were slower for lower-performing than for higher-performing students in Year 8 numeracy.

In both literacy and numeracy, it seems likely that growth for children could be improved if teachers were able to use more of the teaching practices identified in the two observation schedules, CLOS-R and ToMOS. The results for literacy are particularly strong, suggesting that almost all of the unexplained variance between different classes can be explained by the degree of absence or presence of the identified teaching practices.

In the case of literacy, this study provides detailed qualitative examples of the ways in which these practices are incorporated into the classroom routine of more effective teachers. The implication for schools is that teachers need support to incorporate more of the practices identified in the schedule.

In the case of numeracy, this study provides a valuable instrument for measuring teaching quality in lower secondary mathematics classrooms based on observed classroom practice, enabling future research to validate findings and theories of effective mathematics teaching.
1. **LITERACY PHASE 1: ASSESSMENT**

1.1 **CONTEXT**

This research was conducted during a period of controversy and action in both literacy and early childhood education at international, national and state levels. Within literacy education there has been the ongoing ‘literacy debate’, played out in the Australian context in politics and the media, often with a focus on the place of phonics in literacy teaching (see Snyder, 2008, for a review). Within early childhood education there is international debate as to what should be the focus of early years classrooms, with a perceived tension between the explicit teaching of cognitive skills and supporting children’s social and emotional growth, particularly for children from backgrounds that are associated with low levels of school achievement (see for example, Dickinson, McCabe & Essex, 2006).

The ‘literacy debate’ has resulted in several high profile government initiatives, beginning in the United States, where the National Reading Panel conducted an ‘evidence-based assessment of the scientific research literature on reading and its implications for reading instruction.’ (NICHD, 2000) This type of analysis is normally used in research studies of the efficacy of interventions in psychological and medical research for ‘fostering of robust health or psychological development and the prevention or treatment of disease’ (NICHD, 2000). The panel used a stringent set of criteria for inclusion of studies in the analyses and where possible a statistical meta-analysis was conducted and an effect size was calculated for the particular aspect of reading under investigation. The components of reading identified by these methods as having significant positive effects upon children’s reading achievement were phonemic awareness (defined as the ability to focus on and manipulate phonemes in spoken syllables and words), phonics (a method of teaching reading that makes systematic connections between sounds and alphabet letters), fluency (in terms of guided oral reading) and comprehension (including vocabulary knowledge). The research findings of the Panel were used in the United States as the basis for government mandated educational initiatives.

Within the Australian context there has been ongoing concern by some that the findings of the United States National Reading Panel did not appear to be influencing literacy teaching practice in Australia in that, it was claimed, a ‘whole language’ approach was being taken and that phonemic awareness and phonics were not being systematically taught.

This concern was taken up in the media and in 2004, the Australian Minister for Education, Science and Training announced a National Inquiry into the Teaching of Literacy, in order to provide a broad, independent examination of reading research, teacher preparation and practices for the teaching of literacy, particularly reading, that resulted in the Rowe Report *Teaching Reading* (Rowe, 2005). On the basis of observations and research reviewed for this inquiry, the report recommended that:

- Teachers be equipped with teaching strategies based on findings from rigorous, evidence-based research that are shown to be effective in enhancing the literacy development of all children;
- Teachers provide systematic, direct and explicit phonics instruction so that children master the essential alphabetic code-breaking skills required for foundational reading proficiency; equally, that teachers provide an integrated approach to reading that supports the development of oral language, vocabulary, grammar, reading fluency, comprehension and the literacies of new technologies.

In 2006, following the National Inquiry into the Teaching of Literacy, the Western Australian Literacy and Numeracy Review Taskforce was set up in order ‘to improve literacy and numeracy levels of achievement of those students who are struggling, particularly those not reaching the benchmarks in years 3, 5 and 7’. The Taskforce endorsed and extended the recommendations of the Rowe Report in terms of literacy in the early years of school and included in its report (DET, 2007) the recommendation that resources for teachers be developed in the areas of:

- Oral language, including awareness of sounds in words (phonological awareness), phonics and vocabulary, and strategies for teaching home languages and dialects other than Standard Australian English;
- Pre-Primary diagnostic assessment of phonological awareness and follow-up support for children who may later have difficulty in learning to read;
- Year 1 on-entry diagnostic assessment of literacy and numeracy skills.

Within the Western Australian context, over a number of years there have been some changes to the structure of the early school years that have the potential to impact upon literacy education. These include raising the school starting age by six months (for Pre-primary the minimum starting age is 4 years and 6 months on January 1) and provision for full-time Pre-primary and 4-half-day or 2-full-day sessions of Kindergarten attendance. Schooling for Kindergarten and Pre-primary children is not compulsory, but becomes compulsory in Year 1. A particular feature of Pre-primary classrooms is that traditionally many were not physically on the school site, but over time nearly all have been re-located to the school, but are often separated from the rest of the school by a fence. In some schools, often those built in recent years, the Pre-primary classrooms form part of an early years cluster that includes Kindergarten and possibly Years 1 and 2.

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1 A meta-analysis is a statistical literature review. See Camilli et al (2003) for a more detailed description.


3 http://www.literacyandnumeracyreview.det.wa.edu.au
There are some important differences between states in educational provision in the early years across Australia. The two most populous states, New South Wales and Victoria, have compulsory full-time school education for children from the age of five years and the learning environments that these children enter are not particularly different from those of Year 1 children. Further, there is a clear expectation that children will learn to read and write in this year of school. This is not necessarily the case in Western Australia, where the relatively recent move to full-time education and raising of the school entry age have led to a range of attitudes among teachers towards literacy teaching in the Pre-primary year.

### 1.2 AIMS

This section of the report examines the literacy growth of a sample of 1,127 Pre-primary and 1058 Year 1 children in 171 classrooms in Western Australian government schools during the 2005 school year. It addresses the following related questions:

- What is the nature of literacy growth in WA government schools from Term 1 to Term 4 for children in Pre-primary and Year 1?
- How does the literacy growth of WA government school children in the first two years of school compare with a national sample of government school children?
- Which teachers are associated with different amounts of value-added literacy growth for the students in their classes?

### 1.3 METHODOLOGY

**Participants**

The participants in the first phase of the study were Pre-primary and Year 1 teachers in 83 Western Australian Department of Education and Training (DET) schools and the children in their classes. The teachers were recruited from a modified stratified random sample of 100 WA government schools that contained children at these year levels. The sample was stratified according to school size (number of students), sector (rural or metropolitan) and socio-economic index (SEI). Small schools of less than 80 students were removed from the sample as it was likely that classes in these schools would contain fewer than 10 students of each year level, the minimum number desirable for data analysis at the class level.

At the beginning of the study a letter explaining the project from the WA Director General of Education was sent to all DET schools, and on the basis of this a number of schools asked to be included in the study. These schools were allocated to appropriate slots in the sampling frame. The research team then contacted the principals of the schools that had been identified in the random sample, invited the Pre-primary and Year 1 teachers to take part in the project and sent detailed information about procedures and requirements. Not all school principals contacted were able to commit their teachers to the project and some could commit only one teacher. Twelve of the volunteer schools (14.4%) were included in the final sample of 83 schools.

In terms of socio-economic index as set by the Department of Education, Western Australia the participating schools were representative of all DET schools. Overall, the schools were broadly representative of the state population in terms of geographic location, as at the time of sampling 45% of DET schools were in country areas, while 37% of participating schools were in country locations. The mean size of participating schools in terms of student population was 390, which is above the 2004 mean of 285 students. Nevertheless, the slight over-representation of metropolitan schools and the over-representation of large schools may be explained in that small schools, which are normally located in small country towns, were excluded from the sampling frame.

The final sample of classes of children in these schools who were assessed at both the beginning and end of the school year was 171. Eight teachers who had assessed their children at the beginning of the year were unable to complete the end of year assessments so were not included in the analysis. Ninety classes and 1,127 children were in Pre-primary and 81 classes and 1,058 children were in Year 1. Of these, 13.7% of classes (13 Pre-primary and 11 Year 1) were from volunteer schools. Some characteristics of the children who were assessed can be seen in Table 1.

### Table 1

<table>
<thead>
<tr>
<th>General characteristics of the children who took part in the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean PP age on February 1</td>
</tr>
<tr>
<td>Mean Year 1 age on February 1</td>
</tr>
<tr>
<td>Aboriginal or Torres Strait Islander</td>
</tr>
<tr>
<td>*LBOTE</td>
</tr>
<tr>
<td>Identified disability/difficulty</td>
</tr>
<tr>
<td>Female gender</td>
</tr>
</tbody>
</table>

Note *LBOTE - Language background other than English

The mean number of children in the class clusters who were assessed at both testing times was 12. Whilst this may suggest small class sizes it must be taken into account that children were included only if they had parental permission to
participate and were assessed at both testing times. Further, in split-classes only one year level was normally assessed.

Assessment measures

The children’s literacy achievement was assessed using literacy materials from the Longitudinal Literacy and Numeracy Study (LLANS) that were devised by the Australian Council of Educational Research (Meiers, Khoo, Rowe, Stephanou, Anderson & Nolan, 2006). These materials were created in order to measure Australian student performance over time and to develop achievement scales describing growth in literacy from the beginning of school. Sets of linked assessment tasks were devised to include the expected range of children’s literacy knowledge and skills during Pre-Year 1* and Year 1. Two separate assessment instruments were designed for each school year, one to be administered at the beginning of the year; the other at the end. Sets of assessment tasks addressed the following aspects of literacy:

- Making meaning from text;
- Reading fluency;
- Concepts about print;
- Phonemic awareness and
- Writing.

Items of varying and increasing difficulty were included in the set of activities for each assessment. Groups of items were repeated from one assessment to the next, providing links forwards and backwards between the four assessments.

The tasks were designed to be administered individually to children and involved ‘authentic texts’ some of which were high quality children’s picture books, and tasks that would be familiar to children, such as reading aloud from levelled texts, responding to a picture book read aloud by the teacher, writing based on the text read aloud and recognising letters and sounds. A detailed and precise set of instructions was provided to teachers in order to ensure standardisation of procedures, and marking guides provided clear and explicit ways of recording children’s responses.

Detailed information on the LLANS materials, construction of items and literacy achievement scales, based on the Rasch model (Adams & Khoo, 1999; Masters, 1982; Rasch, 1960), can be found in Meiers et al. (2006). Additional information on the scales can be found in Louden et al. (2005).

Assessment of children

Children were assessed by their teachers near the beginning of the school year, in March (Term 1) and again at the end of the year in November (Term 4). At both assessment times teachers were sent a package containing all materials to be used by the children in their class, detailed instructions on administration and scoring, and a brochure that contained photographs and precise explanations of each item in the package. Teachers were asked to assess all children in their classes, although those who taught split-classes containing children from more than one year level, usually Pre-primary/Year 1, were asked to assess the year level in which there were most children, as at least 10 children were required for each class. Whilst in several rural and remote schools the number of children at both year levels was fewer than 10, they were included in the study so that the sample contained a range of schools for this phase of the study. Schools were offered reimbursement for two days of teacher relief over the year in order to allow class teachers time to administer the assessment tasks and to complete surveys. At the beginning of the year teachers were required to gain parent permission to assess the children in their classes. At the end of the year they were asked to complete a brief information sheet for each child who had completed both the beginning and end of year assessments, to provide information about the child’s linguistic and cultural background, any major interruption to learning or learning difficulty/disability, general literacy achievement in class and relative attention in class (using the four attentive-inattentive items from the Rowe Behavioural Rating Inventory 12-item Teacher Form, Rowe & Rowe, 1999, p. 23).

After the second round of assessments teachers were provided with detailed feedback on individual and class growth of the children they had assessed. This feedback took the form of an individual literacy progress map for each participating classroom teacher showing each child’s overall literacy growth in relation to the literacy growth of the statewide sample. In addition two diagnostic reports for school principals provided data on the participating classes for both Term 1 and Term 4 assessments in Pre-primary and Year 1.

* When referring to school years on a national basis the term Pre-Year 1 is used to refer to the school year immediately preceding Year 1. This is necessary as different Australian states use different terms for this school year, such as Kindergarten, Prep, Reception (and Pre-primary in WA).
The results of the analyses of the literacy assessment data in terms of the achievement and growth of the children from Term 1 to Term 4 of the school year are now presented, beginning with an examination of what the Pre-primary and Year 1 children as whole groups were able to do in Terms 1 and 4. This is followed by an analysis of their literacy growth during this time in comparison with a national sample of children of similar ages. Analyses were then made at the class level in order to identify classes in which there was more literacy growth than expected, expected literacy growth, and less than expected literacy growth. These analyses made it possible to identify individual teachers’ classrooms for the next phase of the project.

**Literacy achievement and growth: Term 1 to Term 4**

In order to examine the children's literacy achievement and growth, their scored responses on the literacy assessment items were calibrated on a common logit scale by fitting their response data to Rasch measurement models (see Meiers et al., 2006). An advantage of a common literacy scale upon which children’s achievements can be located, is that it can be used to compare the progress of children over time and also the relative achievement levels of different student groups. Moreover, the data obtained from the scale may be modelled to identify major sources of variation and the magnitude of factors explaining that variation.

In Figure 1 the item variable map for Pre-primary Term 1 achievement can be seen. (The item maps for Pre-primary Term 4 and Year 1 Terms 1 and 4 can be found in Appendix 1). It shows the location on a logit scale of the Pre-primary Term 1 items according to difficulty (right-hand side), and the location of children according to their performances (X’s on the left-hand-side, with each X representing six children). The items that the children found easiest are located at the bottom of the map and those they found hardest at the top. In order to display each item on the map it has been given a code. A descriptor for each item code can be found in Table 2. (Code descriptors for Pre-primary Term 4 and Year 1 Terms 1 and 4 can be found in Appendix 1). All items in Figure 1 have the prefix 1, as this survey was the first in a series of literacy assessments (Meiers et al., 2006). This prefix is followed by a code for the area of knowledge tapped by the item.

In Figure 1 the first numeral following the area descriptor represents the order number of the task. Where items are marked as correct or incorrect (dichotomous) there are no further numerals. As responses to some items could be given a partial score, in some cases a numeral follows the area descriptor indicating the level reached. For example, the item 1EPS assessed a child’s ability to match capital letters within the context of a photograph of a COCO POPS cereal packet from the question, ‘Show me any letters that are the same’. The easiest step for this item was 1EPS.1, which was located at the bottom of the item map, showing that this was the easiest item of all for the Pre-primary children in Term 1. This item step involved a child identifying one of the repeated letters in COCO POPS. The item step 1EPS.2 that was located higher on the map was more difficult in that the child had to identify two or three of the repeated letters.

In order to give some idea of the progression of children’s literacy growth some assessment items, that show what the children could do at the beginning and end of Pre-primary and Year 1, have been selected. The selected items have been taken from word level tasks, rather than comprehension or writing tasks as these often involved partial scoring procedures that make immediate interpretation difficult (for details of these procedures see Meiers et al., 2006).

**Pre-primary**

In the area of phonological awareness at the beginning of the year, nearly all the Pre-primary children demonstrated some rhyming skills, but some items proved to be more difficult for them than others. For all items the teacher pronounced three words in a list as she pointed to a picture that represented the word. The word lists egg leg bag and nose rose bone in which the two rhyming words were pronounced first were the easiest (achieved by 91% and 87% of the children respectively), whereas the list big box pig in which the rhyming words were separated by the non-rhyming word was more difficult (achieved by 51%). A majority of the children were able to complete alliteration tasks, although there was a range of achievement (57%-76%) for different items. Table 3 shows some of the skills the Pre-primary children demonstrated at the beginning of the year, approximately 6-7 weeks into Term 1.

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1 To ensure that children’s item responses were calibrated on the LLANS literacy scale, they were ‘anchored’ to the item threshold values obtained from the first four waves of data in ACER’s LLANS project (see Meiers & Rowe, 2002, Rowe, 2002)
Figure 1. Pre-primary literacy item map for Term 1

Each X represents 6 students
### TABLE 2

**Item descriptors and codes for Pre-primary LLANS Term 1**

<table>
<thead>
<tr>
<th>Item code</th>
<th>Item description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1EP1</td>
<td>Identifies writing in a picture</td>
</tr>
<tr>
<td>1EP2</td>
<td>Reads a single word on a toy box</td>
</tr>
<tr>
<td>1EP3</td>
<td>Reads words on a cereal packet</td>
</tr>
<tr>
<td>1EP4</td>
<td>Identifies some letter names and sounds</td>
</tr>
<tr>
<td>1EP5</td>
<td>Recognises repeated letters in two given words (Coco Pops)</td>
</tr>
<tr>
<td>1EP6</td>
<td>Recognises repeated letters in two pictures</td>
</tr>
<tr>
<td>1EP7</td>
<td>Identifies and reads a number, letter or word</td>
</tr>
<tr>
<td>1EP8</td>
<td>Reads a sign</td>
</tr>
<tr>
<td>1EP9</td>
<td>Identifies and reads a number</td>
</tr>
<tr>
<td>1EP0</td>
<td>Identifies and reads a decimal number</td>
</tr>
<tr>
<td>1PA1</td>
<td>Recognises words that rhyme (egg, leg, bag)</td>
</tr>
<tr>
<td>1PA2</td>
<td>Recognises words that rhyme (big, box, pig)</td>
</tr>
<tr>
<td>1PA3</td>
<td>Recognises words that rhyme (tree, rock, sock)</td>
</tr>
<tr>
<td>1PA4</td>
<td>Recognises words that rhyme (nose, rose, bone)</td>
</tr>
<tr>
<td>1PA5</td>
<td>Recognises words that rhyme (tail, gate, whale)</td>
</tr>
<tr>
<td>1PA6</td>
<td>Recognises words that rhyme (rain, stamp, lamp)</td>
</tr>
<tr>
<td>1PA7</td>
<td>Recognises the same initial sound in short words (leg, man, lip)</td>
</tr>
<tr>
<td>1PA8</td>
<td>Recognises the same initial sound in short words (door, dog, cat)</td>
</tr>
<tr>
<td>1PA9</td>
<td>Recognises the same initial sound in short words (wing, beak, bird)</td>
</tr>
<tr>
<td>1PA0</td>
<td>Recognises the same initial sound in short words (watch, spade, window)</td>
</tr>
<tr>
<td>1Pa</td>
<td>Recognises the same initial sound in short words (shoe, train, ship)</td>
</tr>
<tr>
<td>1PAb</td>
<td>Recognises the same initial sound in short words (book, feather, fish)</td>
</tr>
<tr>
<td>1BO1</td>
<td>Locates the front of a picture storybook (Precious Eggs)</td>
</tr>
<tr>
<td>1BO2</td>
<td>Reads some words correctly from a picture storybook</td>
</tr>
<tr>
<td>1BO3</td>
<td>Identifies the title of a picture storybook</td>
</tr>
<tr>
<td>1BO4</td>
<td>Identifies where text begins in a picture storybook</td>
</tr>
<tr>
<td>1BO5</td>
<td>Identifies which word to read first when reading a picture storybook</td>
</tr>
<tr>
<td>1BO6</td>
<td>Indicates that text is read from left to right</td>
</tr>
<tr>
<td>1BO7</td>
<td>Indicates return sweep to left at the end of a line of text</td>
</tr>
<tr>
<td>1RE1</td>
<td>After listening to a picture storybook, includes several key aspects in a retelling</td>
</tr>
<tr>
<td>1RE2</td>
<td>Offers simple explanation for a character’s behaviour in a picture storybook</td>
</tr>
<tr>
<td>1CP1</td>
<td>Names and describes purpose of a full stop</td>
</tr>
<tr>
<td>1CP2</td>
<td>Names and describes purpose of a question mark</td>
</tr>
<tr>
<td>1CP3</td>
<td>Names and describes purpose of quotation marks</td>
</tr>
<tr>
<td>1CP4</td>
<td>Identifies a word from a page of text</td>
</tr>
<tr>
<td>1CP5</td>
<td>Identifies a letter from a page of text</td>
</tr>
<tr>
<td>1CP6</td>
<td>Identifies first letter in a given word (shade)</td>
</tr>
<tr>
<td>1CP7</td>
<td>Identifies last letter in a given word (shade)</td>
</tr>
<tr>
<td>1CP8</td>
<td>Names letters in a given word (shade)</td>
</tr>
<tr>
<td>1CP9</td>
<td>Reads a given word (shade)</td>
</tr>
<tr>
<td>1CP0</td>
<td>Identifies capital letters</td>
</tr>
<tr>
<td>1CPa</td>
<td>Identifies lower case letters</td>
</tr>
<tr>
<td>1CPb</td>
<td>Identifies capital letter and lower case letters in a given word (they)</td>
</tr>
<tr>
<td>1CPc</td>
<td>Writes own name correctly</td>
</tr>
<tr>
<td>1CPe</td>
<td>Writes a recognisable sentence (words may not be spelt correctly)</td>
</tr>
</tbody>
</table>

- 1EP - environmental print
- 1PA - phonemic awareness
- 1BO - book orientation
- 1RE - retelling
- 1CP - concepts of print
### Table 3

Percentages of Pre-primary children scoring correct responses on a sample of literacy items in Term 1

<table>
<thead>
<tr>
<th>Item</th>
<th>% of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reads the single word LEGO on a toy box</td>
<td>32</td>
</tr>
<tr>
<td>Reads a sign (either BP or SHELL) on a picture of a petrol station</td>
<td>78</td>
</tr>
<tr>
<td>Recognises words that rhyme (big, box, pig)</td>
<td>51</td>
</tr>
<tr>
<td>Recognises words that rhyme (tail, gate, whale)</td>
<td>71</td>
</tr>
<tr>
<td>Recognises words that rhyme (nose, rose, bone)</td>
<td>87</td>
</tr>
<tr>
<td>Recognises words that rhyme (egg, leg, bag)</td>
<td>91</td>
</tr>
<tr>
<td>Recognises the same initial sound in short words (watch, spade, window)</td>
<td>57</td>
</tr>
<tr>
<td>Recognises the same initial sound in short words (shoe, train, ship)</td>
<td>60</td>
</tr>
<tr>
<td>Recognises the same initial sound in short words (leg, man, lip)</td>
<td>70</td>
</tr>
<tr>
<td>Recognises the same initial sound in short words (door, dog, cat)</td>
<td>76</td>
</tr>
<tr>
<td>Identifies lower case letters</td>
<td>27</td>
</tr>
<tr>
<td>Identifies a word from a page of text</td>
<td>72</td>
</tr>
<tr>
<td>Identifies a letter from a page of text</td>
<td>87</td>
</tr>
</tbody>
</table>

The Pre-primary children at this time had some concepts of words and letters: many could point to a word (72%) and a letter (87%) within a page of text and could recognise a BP or SHELL sign on a photograph of a petrol station (78%). On the other hand most did not appear to have detailed knowledge of written words or letters, with just 32% recognising the word LEGO on a photograph of a toy box, and 27% identifying a letter as ‘little’ or lowercase.

In the Term 4 assessment the Pre-primary children were able to demonstrate a wider range of word level knowledge and skills. In addition to recognising rhyme and alliteration, albeit not always consistently, a majority were able to demonstrate identification of final phonemes in words (75% identified /p/ at the end of *pup* and 64% identified /t/ at the end of *coat*). They were also able to demonstrate some knowledge of letter names and sounds, although their knowledge in this area seemed to depend on the particular letter presented and the font in which it was presented, for example the lower case letter *l*, which was sometimes confused with the numeral 1, was recognised by just about half (49%), whereas the lower case *e* was named by most (79%), although not as many could give its sound (59%).

Some of the Pre-primary children’s growth in word level skills over the year can be seen in Table 4 that shows a sample of what these Pre-primary children could do at the end of Term 4.

The children’s recognition of sight words out of context was beginning to develop. A majority (63%) recognised *I* as a word, but their knowledge of longer words was not well-developed, with few (11%) recognising the word *little*. The children’s skill in oral reading, assessed using the Reading Recovery Level 5 text *Monkey on the Roof* (Clough, 2000), was just beginning to develop. Relatively few children (19%) were able to read some or all of this simple text with accuracy.
% of children

<table>
<thead>
<tr>
<th>Item</th>
<th>% of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies words with the same first sound from a list of three (steak, tray, tree)</td>
<td>56</td>
</tr>
<tr>
<td>Identifies words with the same first sound from a list of three (man, mud, goat)</td>
<td>84</td>
</tr>
<tr>
<td>Identifies words with that rhyme from given pairs (hand, bed; hand, sand; hand, house)</td>
<td>68</td>
</tr>
<tr>
<td>Identifies words with that rhyme from given pairs (bunny, money; bunny, balloon; bunny, funny)</td>
<td>79</td>
</tr>
<tr>
<td>Identifies ‘t’ sound at the end of coat</td>
<td>64</td>
</tr>
<tr>
<td>Identifies ‘p’ sound at the end of pup</td>
<td>75</td>
</tr>
<tr>
<td>Names a letter (a)</td>
<td>80</td>
</tr>
<tr>
<td>Names a letter (e)</td>
<td>79</td>
</tr>
<tr>
<td>Names a letter (g)</td>
<td>55</td>
</tr>
<tr>
<td>Names a letter (l)</td>
<td>49</td>
</tr>
<tr>
<td>Makes a sound of a letter (a)</td>
<td>81</td>
</tr>
<tr>
<td>Makes a sound of a letter (e)</td>
<td>59</td>
</tr>
<tr>
<td>Makes a sound of a letter (g)</td>
<td>59</td>
</tr>
<tr>
<td>Makes a sound of a letter (l)</td>
<td>49</td>
</tr>
<tr>
<td>Reads ‘and’ as a sight word</td>
<td>36</td>
</tr>
<tr>
<td>Reads ‘I’ as a sight word</td>
<td>63</td>
</tr>
<tr>
<td>Reads ‘little’ as a sight word</td>
<td>11</td>
</tr>
<tr>
<td>Reads ‘the’ as a sight word</td>
<td>33</td>
</tr>
<tr>
<td>Identifies a word from a page of text</td>
<td>81</td>
</tr>
<tr>
<td>Identifies a letter from a page of text</td>
<td>86</td>
</tr>
</tbody>
</table>

The overall literacy growth of the Pre-primary children during the school year can be seen in Figure 2. This shows, on the left, a selected sample of skill descriptions of achievement at different points on the literacy scale from the easiest (at the bottom) to the hardest (at the top). The two shaded bands on the right show the distributions of achievement in the Pre-primary Term 1 and Term 4 surveys. These shaded bands represent the middle 80% of children, the darker shading represents the middle 50% and the black line in the middle represents the median. It can be seen that whilst there was some growth in literacy at all levels, there was a range of achievement at the beginning of the Pre-primary year and that this range had become much wider by the end of the year. There was relatively little growth at the bottom of the distribution and a large amount of growth at the top.
Figure 2. Literacy scale description and achievement distributions: Pre-primary
Year 1

As for Pre-primary, the Year 1 first assessment was given to the children approximately 6-7 weeks into the school year. Table 5 shows some of the word level skills demonstrated at this time.

Many of the beginning Year 1 children were able to read the simple consonant-vowel-consonant word sun (63%) and to delete the first phoneme in a word (56% deleted /m/ from meat and 52% deleted /b/ from bend). Deleting a phoneme when it was part of an onset, as in deleting /l/ from black, was achieved by a smaller proportion of children (30%). Their ability to use letter patterns in reading and spelling words was developing. When given the word like some were becoming able to use the letter pattern to decode very similar words such as likes (42%) and bike (37%), although few were able to decode more complex letter patterns such as strike (11%) and likely (7%). Few were able to use the letter pattern analogy to spell bike (13%) or liked (11%) and only one third (33%) were able to read some or all of the Reading Recovery Level 8 text Kitty Cat Plays Inside (Smith, 2000) with accuracy.

In Term 4 of Year 1 many children demonstrated sophisticated phonological awareness skills in terms of manipulating phonemes in spoken words. Most were able to delete one phoneme and replace it with another at the beginning of a word (87% deleted /h/ in hat and replaced it with /m/) and the middle of a word (75% deleted /o/ in shop and replaced it with /i/). However, manipulating part of an onset or rime was more difficult (for example deleting /m/ from the onset of smell and replacing it with /p/) was achieved by 45% of children. Manipulating end sounds was generally more difficult than manipulating beginning and middle sounds (only 45% were able to delete the /m/ in stem and replace it with /p/). Nearly all the children (87%) were able to read the simple consonant-vowel-consonant word ten, and many (60%) were able to read some or all of the Reading Recovery Level 15 book Meet My Mouse (Robinson, 1993) with accuracy.

The overall literacy growth of the Year 1 children during the school year can be seen in Figure 3. This shows, on the left, a selected sample of skill descriptions of achievement at different points on the literacy scale from the easiest (at the bottom) to the hardest (at the top). The two shaded bands on the right show the distributions of achievement in the Year 1 Term 1 and Term 4 surveys. These shaded bands represent the middle 80% of children, the darker shading represents the middle 50% and the black line in the middle represents the median. It can be seen that whilst there was a wide range of achievement at the beginning of Year 1 that was still apparent at the end of the year, children at all levels demonstrated large amounts of growth, including those children at the bottom of the distribution.

### Table 5

Percentages of Year 1 children scoring correct responses on a sample of literacy items in Term 4

<table>
<thead>
<tr>
<th>Item</th>
<th>% of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reads words with a similar structure (like/likely)</td>
<td>7</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/likeness)</td>
<td>8</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/strike)</td>
<td>11</td>
</tr>
<tr>
<td>Spells and writes a given word (liked)</td>
<td>11</td>
</tr>
<tr>
<td>Spells and writes a given word (bike)</td>
<td>13</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/spike)</td>
<td>17</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/liked)</td>
<td>28</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/bike)</td>
<td>37</td>
</tr>
<tr>
<td>Reads words with a similar structure (like/likes)</td>
<td>42</td>
</tr>
<tr>
<td>Deletes sounds in words (black/back)</td>
<td>30</td>
</tr>
<tr>
<td>Deletes sounds in words (card/car)</td>
<td>48</td>
</tr>
<tr>
<td>Deletes sounds in words (bend/end)</td>
<td>52</td>
</tr>
<tr>
<td>Deletes sounds in words e.g. takes out m in meat to make eat</td>
<td>56</td>
</tr>
<tr>
<td>Reads words that may require segmenting of letters (sun)</td>
<td>63</td>
</tr>
</tbody>
</table>
In view of the findings about the literacy achievement and growth of the Pre-primary children, it appeared that there might be some differences between the Western Australian Teaching for Growth (TFG) sample of children and those who had taken part in the ACER Longitudinal Literacy and Numeracy Study (LLANS) (Meiers et al., 2006). Since the children in both studies had completed the same literacy assessments at the same points in their school careers comparisons between these groups could be made. The data, therefore, were further analysed.

In both studies children in slightly modified stratified random samples of schools had been administered the same literacy assessments by their teachers in Pre-Year 1 (the Year prior to Year 1) and/or Year 1. In order to allow for valid comparisons, since the TFG children were all from government schools and the LLANS study also included children from non-government schools, all children who had been attending non-government schools were removed from the LLANS database. The following comparisons of literacy achievement and growth therefore are based on data collected from children in government schools only.

The assessment data in each study had been collected from children in Pre-Year 1 or Year 1 in Terms 1 and 4 of the school year. It was collected in 2005 for TFG, and was compared with data from the LLANS children who were assessed in Terms 1 and 4 of 1999 in Pre-Year 1, and in 2000 in Year 1. The Terms 1 and 4 data that had been collected for the Pre-Year 1 and Year 1 children for the TFG study were scored onto the literacy scale developed for the LLANS study. Whilst the children in both studies were in similar school years, that is Pre-Year 1 and Year 1, it was also important to ensure that the children were of similar ages. Table 7 indicates that this was the case, although the mean age of the LLANS sample was one month higher than those of the TFG samples.

### Table 6

<table>
<thead>
<tr>
<th>Item</th>
<th>% of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulates end sounds in words e.g swaps m in stem with p to make step</td>
<td>45</td>
</tr>
<tr>
<td>Manipulates middle sounds in word e.g swaps m in smell with p to make spell</td>
<td>45</td>
</tr>
<tr>
<td>Manipulates end sounds in words e.g swaps t in art with m to make arm</td>
<td>54</td>
</tr>
<tr>
<td>Manipulates middle sounds in word e.g swaps l in blush with r to make brush</td>
<td>55</td>
</tr>
<tr>
<td>Manipulates middle sounds in word e.g swaps u in cup with a to make cap</td>
<td>67</td>
</tr>
<tr>
<td>Manipulates end sounds in words e.g swaps n in bin with g to make big</td>
<td>59</td>
</tr>
<tr>
<td>Manipulates middle sounds in word e.g swaps o in shop with i to make ship</td>
<td>75</td>
</tr>
<tr>
<td>Manipulates beginning sounds in words e.g. swaps c in camp with I to make lamp</td>
<td>80</td>
</tr>
<tr>
<td>Reads words that may require segmenting of letters (ten)</td>
<td>87</td>
</tr>
<tr>
<td>Manipulates beginning sounds in words e.g. swaps h in hat with m to make mat</td>
<td>87</td>
</tr>
</tbody>
</table>

### Table 7

<table>
<thead>
<tr>
<th>Pre - Year 1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>November</td>
<td></td>
</tr>
<tr>
<td>LLANS</td>
<td>TFG</td>
<td>LLANS</td>
</tr>
<tr>
<td>5 yrs 4 months</td>
<td>5 yrs</td>
<td>6 yrs 0 months</td>
</tr>
<tr>
<td>3 months</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 1</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>November</td>
<td></td>
</tr>
<tr>
<td>LLANS</td>
<td>TFG</td>
<td>LLANS</td>
</tr>
<tr>
<td>6 yrs 4 months</td>
<td>6 yrs</td>
<td>7 yrs 0 months</td>
</tr>
<tr>
<td>3 months</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note *LLANS - Longitudinal Literacy and Numeracy Study, TFG - Teaching for Growth*
Controls a variety of simple and complex sentences in own writing. Spells 'basket' correctly.

 Writes simple sentences joined with simple conjunctions eg like, but, then. Controls selected content, includes specific details in own writing.

 Writes several sentences, with consistent and accurate use of full stops and capital letters.

 Identifies key events in a story after listening to a picture story book. Uses context to provide meaning for unfamiliar words in informational text, eg plentiful.

 Segments and blends to pronounce unfamiliar words correctly eg tactical.

 Reads simple reading book (repetitive structure, varied content) with word for word accuracy. Writes readable text, many words spelt correctly and errors are plausible.

 Identifies main idea and provides one or more details after listening to a story. Generalises about meaning of an image in the conclusion to a picture story book.

 Writes a single sentence using an initial capital letter and final full stop. Expresses more than one idea in own writing.

 Writes generally readable text, spelling plausible though many errors. Identifies words in quotation marks within a simple reading book, understands the purpose.

 Locates relevant information after hearing an information text read aloud.

 Listens to an informational text, and identifies specific information, but little detail.

 Manipulates sounds in words, eg takes out the b in bend – what word is left? Makes some errors in the construction of simple sentences.

 Reads 2 to 3 pages of a simple reading book, limited maintenance of meaning. Identifies main character and situation from looking at front cover of a simple reading book.

 Gives a literal interpretation of illustration from a picture story book.

 Understands character’s situation from text and pictures.

 Makes a general comment about an illustration after listening to a picture story book.

 Figure 3. Literacy scale description and achievement distributions: Year 1
Figure 4 shows the distributions of children’s scores from the two studies on the common literacy scale. The maximum, the minimum, the 10th, 25th, 50th, 75th and the 90th percentile scores are marked on each column as follows:

![Figure 4: Literacy growth of TFG and LLANS samples](image)

Note. LLANS - Longitudinal literacy and numeracy study, TFG - Teaching for Growth

**Figure 4. Literacy growth of TFG and LLANS samples**

It will be seen that there were differences between the samples of children in the two studies in terms of both achievement at different points in time, and in patterns of growth. These differences were further explored. Table 8 shows the sample size, mean score and standard deviation for each sample of children at each assessment time. It can be seen that there were distinct differences between the samples at all assessment points: the TFG children had lower mean scores on the literacy scale at all times.

**Table 8**

Means and standard deviations for the two samples of children

<table>
<thead>
<tr>
<th>Assessment time</th>
<th>Sample</th>
<th>N</th>
<th>Mean</th>
<th>Std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre -Year 1 Term 1</td>
<td>LLANS</td>
<td>607</td>
<td>57.59</td>
<td>12.00</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>1127</td>
<td>51.42</td>
<td>7.85</td>
</tr>
<tr>
<td>Pre - Year 1 Term 4</td>
<td>LLANS</td>
<td>562</td>
<td>69.21</td>
<td>13.18</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>1119</td>
<td>57.83</td>
<td>12.08</td>
</tr>
<tr>
<td>Year 1 Term 1</td>
<td>LLANS</td>
<td>498</td>
<td>72.94</td>
<td>14.27</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>1057</td>
<td>64.07</td>
<td>10.43</td>
</tr>
<tr>
<td>Year 1 Term 4</td>
<td>LLANS</td>
<td>476</td>
<td>83.32</td>
<td>11.80</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>1049</td>
<td>80.75</td>
<td>10.77</td>
</tr>
</tbody>
</table>

Note. LLANS - Longitudinal literacy and numeracy study, TFG - Teaching for Growth
Table 9 shows the results of independent-sample t-tests comparing the TFG and LLANS performances. All mean differences were statistically significant at the 0.05 level, showing that the LLANS sample performed significantly better than the TFG sample at the same year level. However, the gaps were much reduced, though still significant, by the end of Year 1.

Table 10 shows the results of paired t-tests comparing the Term 1 and Term 4 means within each group for Pre-Year 1 and Year 1. All groups made significant growth from Term 1 to Term 4, with the TFG Year 1 group making the greatest gains during this time.

In terms of growth, it can be seen that the TFG children had a lower starting point in Pre-primary in 2005 and their growth during the year was much slower than that of the LLANS Pre-Year 1 sample in 1999. Nevertheless, the amount of the Teaching for Growth children’s growth during Year 1 (16.63 points on the literacy scale) was approximately two and a half times the growth in Pre-primary (6.40 points). The LLANS sample showed relatively similar amounts of growth during both years of school (11.56 and 10.78 points).

The TFG children demonstrated a very different pattern of growth compared to the national sample in that the WA Pre-primary sample showed slower growth than the Pre-Year 1 LLANS sample, and the Year 1 sample showed accelerated growth in comparison with the LLANS sample. Preliminary analysis of this data suggested that there might be some differences in patterns of growth in particular areas for the TFG Pre-primary sample that might be related to the disproportionate amounts of growth for the two year levels. In order to investigate this differential growth pattern further the Pre-primary Term 4 assessment data were examined at the item level.

**Table 9**

*Mean differences in performance between the TFG and LLANS*

<table>
<thead>
<tr>
<th>Assessment time</th>
<th>Mean difference</th>
<th>Std. error</th>
<th>t</th>
<th>Prob.</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Year 1 Term 1</td>
<td>6.178</td>
<td>0.540</td>
<td>11.438</td>
<td>0.000</td>
<td>(5.12, 7.24)</td>
</tr>
<tr>
<td>Pre-Year 1 Term 4</td>
<td>11.382</td>
<td>0.663</td>
<td>17.167</td>
<td>0.000</td>
<td>(10.08, 12.68)</td>
</tr>
<tr>
<td>Year 1 Term 1</td>
<td>8.873</td>
<td>0.715</td>
<td>12.404</td>
<td>0.000</td>
<td>(7.47, 10.28)</td>
</tr>
<tr>
<td>Year 1 Term 4</td>
<td>2.575</td>
<td>0.635</td>
<td>4.056</td>
<td>0.000</td>
<td>(1.33, 3.82)</td>
</tr>
</tbody>
</table>

Note: LLANS - Longitudinal literacy and numeracy study, TFG - Teaching for Growth

**Table 10**

*Growth from Term 1 to Term 4: paired t-tests within groups*

<table>
<thead>
<tr>
<th>Assessment time</th>
<th>Sample</th>
<th>Growth from Term 1 to Term 4</th>
<th>Std. error</th>
<th>t</th>
<th>Prob.</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Year 1</td>
<td>LLANS</td>
<td>11.560</td>
<td>0.402</td>
<td>28.736</td>
<td>0.000</td>
<td>(12.35, 10.77)</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>6.400</td>
<td>0.242</td>
<td>26.432</td>
<td>0.000</td>
<td>(6.87, 5.92)</td>
</tr>
<tr>
<td>Year 1</td>
<td>LLANS</td>
<td>10.774</td>
<td>0.394</td>
<td>27.364</td>
<td>0.000</td>
<td>(11.55, 10.00)</td>
</tr>
<tr>
<td></td>
<td>TFG</td>
<td>16.629</td>
<td>0.238</td>
<td>69.790</td>
<td>0.000</td>
<td>(17.0, 16.16)</td>
</tr>
</tbody>
</table>

Note: LLANS - Longitudinal literacy and numeracy study, TFG - Teaching for Growth
When the relative differences in item difficulties between the TFG and the LLANS Pre-Year 1 samples were compared a pattern emerged that might help explain some differences in patterns of growth. Figure 5 shows a plot of the item difficulties for the TFG Pre-primary sample in the Term 4 assessment against the item difficulties for the LLANS sample. The items included in this plot and represented by dots are the 59 items (out of a total of 100) that relate to word recognition and phonemic awareness. The items are categorised into the four groups: Sight words, Letters and sounds, Words and sounds, and Rhyming words. Sight words measured word recognition; Letters and sounds measured letter recognition in terms of letter names and sounds; Words and sounds measured the phonemic awareness skills of identifying initial and final sounds and segmenting spoken words; and Rhyming words measured the ability to discriminate between spoken pairs of rhyming and non-rhyming words.

The two sets of item difficulties are centred at the same mean (they have already been adjusted for the difference in performance of the two groups). If there were no difference in the relative difficulties, the items should lie close to a diagonal line through the origin. The pattern shown on the plot has the Letters and sounds and the Words and sounds items close to the diagonal, while the Sight words items move up as a set and the Rhyming words items move down as a set. This shows that in Term 4 the Sight words items were relatively more difficult for the Teaching for Growth Pre-primary children than for the LLANS children, while the Rhyming words items were relatively easier.
1.6 Student Literacy Growth and Teacher Effectiveness

To estimate student learning gains for the TFG sample, after taking into account prior performance and some student-level variables, multilevel models (see Rowe, 2001) were fitted to the literacy assessment data separately for the Western Australian Pre-primary and Year 1 samples. The analyses were based on two-level hierarchical models with students nested within classes. The aim of these analyses was to estimate the approximate effect of the classroom teacher on student learning after taking into account possible student-level effects.

Sources of variation

An unconditional model without any predictors was first specified and estimated with Term 4 literacy scores as the outcome variable in order to assess the proportions of variation at the student and classroom levels. This analysis was performed separately for Pre-primary and Year 1. It was found that variation between classes accounted for 24.8% of the total variance in the Pre-primary literacy scores in Term 4 (with 75.2% of the variance at the student level) and 22.9% of the total variance in the Year 1 literacy scores in Term 4 (with 77.1% of the variance at the student level).

With the addition of prior performance in Term 1 as a predictor in the student-level model, the results showed that Term 1 scores were highly significant predictors for both Pre-primary and Year 1. Term 1 scores accounted for 56.1% of the total variance in the Pre-primary Term 4 scores and 55.9% of the total variance in the Year 1 Term 4 scores. Adding significant student-level predictors (disability, interruption to learning and relative attentiveness) to the Pre-primary student-level model increased the proportion of total variance explained from 56.1% to 58.5%. For the Year 1 student-level model, disability, interruption to learning, relative attentiveness and Aboriginal or Torres Strait Islander status were significant predictors. The addition of these four student-level variables increased the proportion of total variance explained from 55.9% to 59.5%.

Value-added measures

The term ‘value-added’ here refers to the extra value that is added by teachers to students’ attainment over and above the progress that might be expected normally. Class-level ‘value-added’ measures can be applied in order to identify the teachers whose students achieved statistically greater progress than expected. The value-added measure is calculated by estimating the difference between the class mean and the grand mean, after adjustment for the effects of prior performance and student-level variables (see Fitz-Gibbon, 1996; Tymms, 1999). This difference is termed the ‘class-level residual’. These residuals have uncertainty attached to them.

Figures 6 and 7 show the class-level residuals for Pre-primary and Year 1 that represent the deviations from the expected adjusted average learning gain between the beginning and end of year assessments. The residuals, which are ranked in order from negative to positive, identify those classes where children made more or less progress than expected, after accounting for prior performance and student-level variables. For each class the residual (distance of the small square from the zero-reference line) and the associated 95 percent confidence interval (represented by vertical lines) are shown.

The confidence interval for a class residual is wider, showing greater uncertainty, if there are fewer students in the class or if there is greater variability in the student scores within the class. If any portion of the confidence interval overlaps with the zero-reference line, then the learning gain is not considered to be significantly different from normal expectation ($p$ level = 0.05). If the small square with the associated confidence interval for a class is clearly above the horizontal reference line, then we can conclude with confidence that the class has achieved better performance than expected. Similarly, if the small square with the associated confidence interval for a class is clearly below the horizontal reference line, then we can conclude with confidence that the class has performed less well than expected.

Ninety of the Pre-primary classes that participated in the study had both beginning and end of year assessment data, in addition to student survey data supplied by the classroom teachers. The ranking of Pre-primary residuals showed that 19 classes had significantly lower than expected student learning gains and 15 classes had student learning gains that were significantly higher than expected (see Figure 6).
Eighty-one of the Year 1 classes that participated in the study had beginning and end of year assessment data, in addition to the student survey data. The ranking of the Year 1 residuals showed that 16 classes had significantly lower than expected student learning gains, and 16 classes had student learning gains that were significantly higher than expected (see Figure 7).
1.7 SUMMARY

The Teaching for Growth sample of children, as a whole, demonstrated growth on the literacy scale from Term 1 to Term 4 in both Pre-primary and Year 1.

There was, however, considerable variability in achievement at the beginning of Pre-primary. This variability was greatly increased by the end of the year. The greater variation was manifested in little literacy growth at the bottom of the distribution and relatively high growth at the top. That is, children who arrived at the beginning of the Pre-primary year with limited literacy skills were likely, on average, to make little progress in literacy during their Pre-primary year. On the other hand, children who arrived with more developed literacy skills were much more likely to make substantial progress in literacy during their Pre-primary year.

In contrast, rates of growth in literacy in Year 1 were consistent at all points of the distribution. The amount of growth overall in Year 1 was approximately two and a half times that in Pre-primary and this growth was evident at all levels, including the bottom of the distribution.

These characteristics of the Western Australian children’s performance – limited growth at the bottom of the distribution in Pre-primary and substantial growth at all levels of performance in Year 1 – were not present in a national sample of children at similar ages using the same assessment instruments and procedures in 1999.

An analysis of the scores of children in government schools in the national sample showed that children in the Western Australian sample showed a lower level of achievement at the beginning of Pre-primary than the national sample, and that lower level of performance was maintained at the end of the year. In Term 1 of Year 1 the achievement gap between the national and Western Australian samples was becoming smaller. By the end of Term 4 of Year 1, the gap was noticeably smaller but the Western Australian group was still performing at a significantly lower level than the national sample.

There were also differences in areas of achievement between the Western Australian and national samples. The Western Australian Pre-primary children found the discrimination of rhyming and non-rhyming words relatively less difficult when compared with the national sample, and they found word recognition relatively harder.

In order to explore the impact of teachers’ literacy teaching practices on these achievement results, a value-added analysis was undertaken to identify teachers in whose classrooms there was more than expected, as expected, and less than expected literacy growth. This allowed for the linking of estimates of growth in student achievement to teachers’ pedagogical practices in the classroom observation phase of the study.

2. LITERACY PHASE 2: CLASSROOM OBSERVATION - QUANTITATIVE ANALYSIS

2.1 AIMS

This section of the report addresses the quantitative relationship between teacher effectiveness and classroom practice. It describes how teachers’ residuals from the value-added analyses were used to identify groups of teachers of differing levels of literacy teaching effectiveness, how individual teachers were selected to take part in video observations and how video data were analysed in terms of the Classroom Literacy Observation Survey – Revised (CLOS-R). The following research questions are addressed:

What is the nature of the quantitative relationship between student growth and teachers’ classroom practices? Specifically:

• Are there any differences between groups of teachers, identified as more effective, effective and less effective, in terms of the frequency of their observed CLOS-R literacy teaching practices?
• Does the CLOS-R represent a consistent and valid scale with which to observe teachers’ classroom literacy teaching practices?

2.2 METHODOLOGY

On the basis of their results from the value-added analysis, teachers were selected for site visit video observations. Accordingly, they were allocated to one of three groups. In classrooms where children in the previous year had achieved significantly lower than expected student learning gains teachers were classified as ‘less effective’; in classrooms where children had achieved significantly higher than expected student learning gains teachers were classified as ‘more effective’; and in classrooms where children had achieved expected learning gains teachers were classified as ‘effective’.

Teachers who took part in the site visit video observations met the following criteria:

• They were teaching at the same year level in the same school in 2006 as in 2005;
• They and their schools agreed to take part in this phase of the study;
• The cluster size of children assessed at both testing times the previous year was normally 10 or more, although one teacher with a cluster size of eight and one of nine were included as these two teachers were teaching in split-classes.

1 It is recognised that teachers may be effective in many different ways. However, for the purposes of this study, teacher effectiveness is defined solely in terms of the LLANS literacy assessment residual scores of the sample of children in each teacher’s class.
Table 11

Details of teachers who took part in the observation phase of the study

<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>Code</th>
<th>Residual</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre - primary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More Effective</td>
<td>PME2</td>
<td>6.17</td>
<td>Metro</td>
</tr>
<tr>
<td>More Effective</td>
<td>PME3</td>
<td>5.67</td>
<td>Country</td>
</tr>
<tr>
<td>More Effective</td>
<td>PME5</td>
<td>3.86</td>
<td>Metro</td>
</tr>
<tr>
<td>More Effective</td>
<td>PME7</td>
<td>3.66</td>
<td>Metro</td>
</tr>
<tr>
<td>Effective</td>
<td>PEF1</td>
<td>1.85</td>
<td>Metro</td>
</tr>
<tr>
<td>Effective</td>
<td>PEF2</td>
<td>0.91</td>
<td>Country</td>
</tr>
<tr>
<td>Effective</td>
<td>PEF3</td>
<td>0.76</td>
<td>Metro</td>
</tr>
<tr>
<td>Effective</td>
<td>PEF7</td>
<td>-0.47</td>
<td>Metro</td>
</tr>
<tr>
<td>Less Effective</td>
<td>PLE2</td>
<td>-3.09</td>
<td>Country</td>
</tr>
<tr>
<td>Less Effective</td>
<td>PLE4</td>
<td>-4.60</td>
<td>Country</td>
</tr>
<tr>
<td>Less Effective</td>
<td>PEF7</td>
<td>-4.60</td>
<td>Metro</td>
</tr>
<tr>
<td>Year 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More Effective</td>
<td>1ME1</td>
<td>6.37</td>
<td>Metro</td>
</tr>
<tr>
<td>More Effective</td>
<td>1ME4</td>
<td>4.51</td>
<td>Metro</td>
</tr>
<tr>
<td>More Effective</td>
<td>1ME6</td>
<td>3.85</td>
<td>Country</td>
</tr>
<tr>
<td>Effective</td>
<td>1EF4</td>
<td>0.45</td>
<td>Metro</td>
</tr>
<tr>
<td>Effective</td>
<td>1EF5</td>
<td>0.40</td>
<td>Country</td>
</tr>
<tr>
<td>Effective</td>
<td>1EF6</td>
<td>-0.13</td>
<td>Metro</td>
</tr>
<tr>
<td>Less Effective</td>
<td>1LE1</td>
<td>-2.53</td>
<td>Metro</td>
</tr>
<tr>
<td>Less Effective</td>
<td>1LE3</td>
<td>-3.94</td>
<td>Country</td>
</tr>
</tbody>
</table>

Note: The teachers have been allocated a code as follows: P or 1 indicate the year level, Pre-Primary or Year 1. ME, EF and LE indicates the level of effectiveness based on the children's literacy growth; more effective, effective or less effective. The final numeral denotes the ranking within the effectiveness level.

All teachers who met these criteria and had been identified as significantly more effective or less effective were invited to take part in this phase of the project. Also invited were teachers identified as effective, that is they had a value-added residual score of between +1 and -1. Some teachers who were invited had moved to other schools, which was often the case for the less effective teachers; some were teaching in other year levels or had been promoted out of the classroom within the same school; others did not choose to take part in this phase of the project for a variety of reasons, many perceiving the presence of a video team in their classroom for two to four days too personally demanding or disruptive to the learning processes in their classrooms.

The final sample of teachers for this second phase of the study were located in 11 classrooms that contained Pre-primary children and 8 that contained Year 1 children. Whilst in most of these classrooms there was consistency of age range and teacher, there were some variations. One of the Pre-primary classrooms contained some Year 1 children, another contained some Kindergarten children, one Year 1 classroom contained some Year Two children and the teaching of one Year 1 class was shared between two teachers. It can be seen in Table 11 that the groups were clearly differentiated in terms of their value-added residuals, with the more effective teachers having residuals of 3.66 or more, the less effective teachers having residuals of -2.53 or less and the effective teachers having residuals of between -0.47 and 0.91, with the exception of one teacher who had a residual of 1.85.

The teachers were located in schools that contained children from a range of socio-economic levels (reported in this study in bands from 0-8). Of the 19 teachers, 10 were located in schools with a band of 0-4, and 9 in schools with a band of 5-8. The teachers were located in schools of various sizes. Eleven were in schools that contained between 100 and 499 students and 9 were in schools of between 500 and 999 students. The smallest was a rural District High School that contained just over 100 students from Kindergarten to Year 10.
Respect
1. Rapport
The teacher creates a warm, positive and inviting classroom where relationships with children encourage literacy learning (Scheerens & Bosker, 1997; Snow et al., 1998; Brophy & Good, 1986; DfEE, 2000; Hattie, 2003; Pianta, 2006)

2. Credibility
Children's respect for the teacher enables her to maintain order and lesson flow (Brophy & Good, 1986; Scheerens & Bosker, 1997; DfEE, 2000; Hattie, 2003)

3. Citizenship
The teacher promotes equality, tolerance, exclusivity and awareness of the needs of others (Education Queensland, 2002)

Knowledge
4. Purpose
Children's responses indicate tacit or explicit understanding of the purpose of the literacy task (Mazzoli & Gambrell, 2003; Wray et al., 2000)

5. Substance
The teacher provides a lesson/task that leads to substantial literacy engagement, not busy-work (Education Queensland, 2002; Hattie, 2003)

6. Explanation word
The teacher clearly explains specific word, letter or sound strategies or concepts (Ehri & Roberts, 2006; Juel, 2006; Byrne & Fielding Barnsley, 1991)

7. Explanation sentence
The teacher clearly explains specific grammatical strategies or concepts (Snow et al., 1998; Wray et al., 2000; Rego & Bryant, 1993; Tunmer & Hoover, 1992)

8. Explanation text
The teacher clearly explains specific textual strategies or concepts (Mazzoli & Gambrell, 2003; NRP, 2000; Snow et al., 1998; Duffy, 2003; Duke & Pearson, 2002)

9. Metalanguage
The teacher provides children with language for talking about and exemplifying literacy concepts (Olson, 1994; Education Queensland, 2002; Morrison, Connor & Bachman, 2006)

10. Oral language
The teacher focuses on the development of children's oral language (Snow et al., 1998; Senechal, Ouellette & Rodney, 2006; Dickinson, 2001)

11. Oral/written language
The teacher makes logical connections between oral and written language (Dickinson, 2001; Dickinson et al., 2006; McKeown & Beck, 2006)

Orchestration
12. Awareness
The teacher has a high level of awareness of literacy activities and participation by children (Hattie, 2003; Snow et al., 1998)

13. Environment
The teacher uses the literate physical environment as a resource (Hattie, 2003; Snow et al., 1998; Wray et al., 2000)

14. Structure
The teacher manages a predictable environment in which children understand consistent literacy routines (Brophy & Good, 1986; DfEE, 2000; Hill et al., 1998; Scheerens & Bosker, 1997)

15. Independence
Children take some responsibility for their own literacy learning (Education Queensland, 2002; Mazzoli & Gambrell, 2003; Snow et al., 1998)

16. Pace
The teacher provides strong forward momentum in literacy lessons (Brophy & Good, 1986; Wray et al., 2000)

17. Transition
The teacher spends minimal time changing activities or uses this time productively (Bloom, 1976; DfEE, 2000; Strickland, 2001)

18. Attention
The teacher ensures that children are focused on the literacy task (Rowe & Rowe, 1999; Wray et al., 2000)

19. Stimulation
The teacher motivates interest in literacy through the creation of a pleasurable, enthusiastic and energetic classroom (Brophy & Good, 1986; Hattie, 2003; Scheerens & Bosker, 1997; Mazzoli & Gambrell, 2003; Snow et al., 1998)

Support
20. Assessment
The teacher uses fine-grained knowledge of children's literacy performance in planning and teaching (Hill & Crevola, 1999; Louden et al., 2000; Wray et al., 2000)

21. Scaffolding
The teacher extends literacy learning through reinforcement, modification or modelling (Bloom, 1976; Brophy & Good, 1986; Taylor et al., 2000; Wray et al., 1999; Wray et al., 2000)

22. Feedback
The teacher intervenes in timely, focused, tactful and explicit ways that support children's literacy learning (Bloom, 1976; Hattie, 2003; Strickland, 2002)

23. Responsiveness
The teacher is flexible in sharing and building on children's literacy contributions (Brophy & Good, 1986; Hattie, 2003; DfEE, 2000)

24. Persistence
The teacher provides many opportunities to practise and master new literacy learning (Brophy & Good, 1986; Wray et al., 1999)

Differentiation
25. Challenge
The teacher extends literacy learning through new, higher-level thinking (Brophy & Good, 1986; DfEE, 2000; Education Queensland, 2002; Hattie, 2003; Snow et al., 1998; Mazzoli & Gambrell, 2003)

26. Inclusion
The teacher extends literacy learning through individualised and small group instruction (Brophy & Good, 1986; DfEE, 2000; Education Queensland, 2002; Hattie, 2003; Wray et al., 2000)

27. Connection
The teacher makes connections between class or community literacy-related knowledge and the children's literacy experiences (Education Queensland, 2002; Hattie, 2003; Wray et al., 2000)

TABLE 12
Classroom Literacy Observation Schedule - Revised (Louden & Rohl, 2008)
The Classroom Literacy Observation Schedule – Revised (CLOS-R) (See Appendix 3) was used to analyse literacy teaching practices in the selected teachers’ classrooms. An earlier version (CLOS) that consisted of 33 teaching practices, grouped into six dimensions, was created by Louden and Rohl (2003) for the In Teachers’ Hands study (Louden et al., 2005). CLOS was devised as a tool with which to observe teachers of literacy in the early years of school. The CLOS teaching practices were based on key research findings in the areas of effective teaching in general, literacy teaching and learning, and effective teaching of literacy, with an emphasis on the effective teaching of early literacy. The resultant CLOS-R that contains 27 teaching practices grouped into five dimensions can be found in Table 12, with a justification for each practice based on examples from the research bases that were synthesized for its development.

Observation of the teachers

Once the 19 teachers had agreed to take part in this phase of the study members of the research team visited their classrooms as non-participant observers. The purpose of the first visit was to explain in detail the planned procedures for the observations. Teachers were asked to carry out their normal literacy teaching practices and activities so that their typical practices during their literacy teaching time were recorded. Two researchers and a professional two-person video team (a videographer and a sound recordist) then spent between two and four days in each classroom, recording and observing literacy teaching and learning. The role of one researcher was to make field notes of the context and classroom activity, particularly noting any features that were not being captured on the video camera. The other researcher directed the video team in terms of what and whom to video in terms of the teacher, children, groups, activities and the balance of sound between the teacher and classroom recorders.

Five types of record were produced through this program of observation:

- Field notes that took the form of a running schedule of activities in the classroom (see Appendix 2 for an example);
- Digital video recordings with sound;
- Digital audio recordings of each teacher’s classroom talk that was recorded as part of the video and later transcribed;
- Teachers’ written responses to a structured interview with a researcher;
- The school principal’s written responses to an interview with a researcher.

Analysis of the video data

The video was analysed using the Artichoke computer software (Fetherston, 2007). Artichoke is a suite of programs designed for analysing video data in various ways. In this study Artichoke was used firstly to analyse the classroom data in terms of the frequency of CLOS-R practices demonstrated by each teacher and secondly to analyse the quality of a group of selected practices.

After the raw video footage had been compressed and converted into QuickTime® a selection was made of two hours of video considered to be typical of each teacher’s literacy practice. The two hours were divided into ten 12-minute episodes that were then transcribed. These 12-minute episodes (190 in total) and their corresponding transcripts were entered into the Artichoke Input program and coded for frequency of each of the 27 CLOS-R teaching practices. Figure 8 shows the layout of the working window of the Artichoke Input program.
Coding of the video data

Four members of the research team, who were all experienced in the teaching of literacy in the early years, were involved in coding the 190 video episodes. All four researchers coded six episodes in a pilot-coding phase that was continued until 90% inter-rater agreement was consistently reached. Each subsequent episode was coded by two of the team working together, and inter-rater reliability checks were undertaken regularly, with 28 episodes cross-coded. Overall inter-rater reliability was 94% agreement and all cross-coded episodes were discussed by the team and amendments to coding, where necessary, were made by agreement of at least three team members.

Reliability of coding was facilitated by the consistent use of a coding manual (see Appendix 3). This contained an expanded definition of each of the 27 practices in CLOS-R and provided key indicators for each teaching practice along with examples of what that teaching practice could look like in the classroom. These examples were based on teaching practices coded for the In Teachers’ Hands study, either from the initial data coding or from examples coded for the project website. For the Knowledge dimension practices that were added to CLOS-R, examples were taken from the pilot coding and from previous studies of literacy teaching (for example Wray et al., 2000). Most of these indicators refer to teacher behaviour, although some refer to the behaviour of the children. The manual allowed members of the research team to develop a common understanding of teaching practices in both Year 1 and Pre-primary classrooms. As three of the team members had extensive personal experience of Kindergarten and Pre-primary teaching in WA, it was possible to take account of the teaching practices of WA early years teachers and of the developmental levels of children in the Pre-primary year. The manual was constantly referred to during coding and analysis in order to maintain a clear understanding of each teaching practice that ensured consistency in coding amongst members of the research team and across teachers.

During the coding process discussions were held amongst the research team and minor changes to the manual were made in order to clarify teaching practice definitions. Any new examples that at least two researchers agreed should be included in the manual were discussed by the team and added when all were satisfied that the example fulfilled the specified criteria.

2.3 Quantitative Findings from the CLOS-R Observational Data

In order to explore the quantitative relationship between teachers’ classroom practices and the observational data from their classrooms, an examination was made of the mean CLOS-R scores for the groups of teachers classified as more effective, effective and less effective. Table 13 shows the mean CLOS-R scores out of a total possible score of 270 for each of the three groups of teachers.

<table>
<thead>
<tr>
<th>Teacher group</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>More effective</td>
<td>233.71</td>
<td>9.83</td>
</tr>
<tr>
<td>Effective</td>
<td>143.43</td>
<td>48.85</td>
</tr>
<tr>
<td>Less effective</td>
<td>77.20</td>
<td>28.23</td>
</tr>
</tbody>
</table>

A one-way ANOVA indicated a significant difference between the means of the groups ($p=0.015$, df=2). The one-way ANOVA post-hoc contrasts indicated significant differences between the means of the less effective and effective teachers ($p=0.043$) and the effective and more effective teachers ($p=0.007$). Homogeneity of variance was not assumed in these post-hoc tests of significance.

Teachers had been classified into three groups on the basis of the literacy growth of children in their classrooms. The observations made using CLOS-R enabled measurement of the teaching practices of each teacher. The Rasch (1960) measurement model was used to establish whether interval-level measurements could be obtained from the CLOS-R data as measurements were available for two variables, that is, for student growth and teacher behaviours.

This strategy was able to ascertain whether there was a correlation between the teacher behaviours as measured using CLOS-R, and student growth as measured by LLANS assessments. This made it possible to establish whether there was a relationship between the variables based on the measurements of individual teachers and to ascertain the nature of possible relationships.

With this analysis strategy employed, the data showed a very good fit to a simple linear regression line of best fit. The Pearson product-moment correlation was $r = 0.93$. The evidence therefore indicated a strong, and approximately linear, relationship between teaching practices and student growth.

More specifically, the correlation was computed between teaching practices and residuals from the hierarchical modelling of student growth data. The correlation implies that variance of the measurements of teaching practices accounts for the majority of variance of the residuals from the hierarchical modelling. That is, variation in teaching practices accounts for the majority of variance in student growth that was not accounted for by other variables used in the hierarchical modelling of the growth data. Specifically, variation in teaching practices accounts for approximately 0.87 of the variance among these residuals.
Because the teachers were purposely selected into three groups, greater variance among the teachers’ effectiveness would be expected than if the teachers had been selected at random. Correlation is computed based on covariance and higher covariance between two variables is possible when the variance is itself higher. Therefore, a smaller correlation is likely to exist among all teachers and it is not possible to infer a correlation for the larger population of teachers from the correlation reported above.

On the other hand, however, measurement error limits the possible variance among the residuals that can be accounted for by measurements of teacher effectiveness based on observations of practices. This means that the actual correlation for the selected teachers is even higher than the reported correlation. Further work would be required to establish more accurately the correlation across all teachers. Clearly though, the very high observed correlation is unlikely to have been found unless there was a more general relationship.

Rasch modelling of CLOS-R observational data

The Rasch model was used to establish whether the CLOS-R data could be used to establish an interval-level measurement scale of the quality of teaching practice based on observations of the specific practices. The observational data fitted the model well, indicating that it was possible to obtain such measurements.

The separation index for the Rasch modelling was 0.92. This is directly analogous to the traditional Cronbach’s alpha, and generally of very similar magnitude (Andrich, 1982). Each practice was treated in the analysis as an item. Each episode for each teacher was treated as a case and the data was comprehensively examined to determine whether or not each practice was evident in each episode. This made it possible to construct an interval-level scale of measurements of episodes. The mean of the measurements of episodes, for a given teacher, was treated as the overall measurement of a given teacher’s practices.

An alternative and more refined analysis was also undertaken, in which scores were summed across episodes for each teacher. This analysis accounted for the greater dependence of data across episodes for each teacher than between teachers. The estimated scale locations for teachers from this analysis correlated almost perfectly with the mean estimates from the first analysis, indicating either was appropriate for use in the research.

It will be seen in Table 14 that the tests of fit indicated there was generally strong fit to the Rasch model for most items. Based on the Chi-square test of fit reported by RUMM2020, the worst fitting item was Environment (Item 13). Independence (Item 15) and Transition (Item 17) also had somewhat poor fit. In all three cases, the items discriminated relatively weakly, which would tend to reduce the separation somewhat. The majority of items had acceptable fit residuals, which are log-transformed forms of the Outfit statistic, or mean-squared standardised residual. The exceptions were generally highly discriminating items such as Substance (Item 5), Awareness (Item 12), Pace (Item 16) and Scaffolding (Item 21), all of which had fit residuals less than -2.5. Nevertheless, the anomalies had a relatively small impact on the estimates used for the purpose of this research, and generally the fit of data to the Rasch model was sound.

Figure 9: Linear regression between CLOS-R measurements and hierarchical modelling standardised residuals
Item maps were produced to establish construct validity. Items with low scale locations should be demonstrated even by the least effective teacher, as the scale location is the threshold beyond which it is more likely than not the teacher will demonstrate the practice in a given episode. On the other hand, greater effectiveness should be required to demonstrate practices with high thresholds, or scale locations, if the construct has been validly measured, given its operationalisation. Thus, a teacher with a higher total score than another has demonstrated the particular observed practice in more episodes. A feature of the Rasch analysis is the reflection of items (in this instance, observations of teaching practices) and persons (teachers) on the same scale. The item map shown in Figure 10 provides a graphical display of this information and shows the locations of the observed practices on the same scale as the locations of the teachers.

In this item map, as in Table 11, teachers are coded as follows: P or 1 identifies the year level ME, E or LE indicates the level of effectiveness based on the children’s classroom literacy growth and the final numeral indicates the ranking within the effectiveness level.

The scale values derived from the analysis range from -3.8 logits to +3 logits. The scale location of each teacher is shown on the left hand side of the display and the location of each practice is shown on the right. Teacher PLE5 has a location of -2.4 and as such displayed the CLOS-R teaching practices the least number of times of all the teachers. Teachers 1ME1, 1ME6, PME2 and PME7 have very similar locations (+2.7 logits to +3 logits) and these teachers displayed these teaching practices the most often. It can be seen that the more effective teachers are clustered at the top of the scale, from

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<th>ChiSq</th>
<th>DF</th>
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In Table 14, item locations and fit statistics from the RUMM analysis of CLOS-R data.
logit locations 2.1 to 3. Three of the less effective teachers are clustered at the bottom of the scale, in logit locations -2.4 to -1.8 with the other two teachers in this group at locations -1 and -0.5. The effective teachers have a much wider spread of locations on the scale with two of them near the more effective teachers at locations 1.8 and 1.9 and the rest from -0.1 to -1.2.

In terms of teaching practices, Credibility has a location of -3.8 logits and was the teaching practice most frequently observed, whereas the least observed practices of Explanation Sentence, Independence and Responsiveness have locations of +2 logits and +2.2 logits respectively.

When the scale locations of the teaching practices are considered in conjunction with the evidence of student growth, it appears that there is in effect a continuum of development in teaching practices. Based on the CLOS-R data, the practices of Credibility and Rapport are low-level practices (in that all teachers demonstrated them in some episodes) and the practices of Responsiveness, Explanation Sentence and Independence are high-level practices that fewer teachers incorporated into their teaching. It can seen that the teachers whose students showed the most literacy growth demonstrated all the teaching practices, including the high level practices, more often than the teachers whose students made limited growth.

Correlations between person-item residuals were inspected to further establish construct validity by interrogating the data for evidence of multidimensionality. The analyses of person-item residuals confirmed a somewhat greater relationship between items pertaining to the ‘Respect’ dimension.

The evidence obtained from Rasch modelling therefore indicates that in addition to internal consistency evident from the separation index, the construct was also valid. Clearly, the separation and validity established through the analyses would be expected, given the strong correlation between these measurements and the residuals from the hierarchical modelling of growth data.

In order to illustrate the information about an individual teacher that can be derived from the Rasch analysis, it is appropriate to look at what it means for teacher 1EF6 (see Figure 10). This Year 1 effective teacher has approximately a 50% probability of incorporating the teaching practice of Substance into her lessons, an increasingly higher probability of using the practices that have a lower scale location than her own, and a decreasingly lower probability of using the practices that have a higher location than hers. She has a somewhat lower than 50% probability of focusing explicitly on word level concepts and skills, providing scaffolding for children and adjusting the pace of her lessons. It is least probable that she will demonstrate teaching based on assessment, providing sentence-level explanations, teaching for independence in literacy learning and responding flexibly to children's literacy contributions.
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**Key**

- 1 = Year 1
- P = Pre-primary
- ME = More effective
- EF = Effective
- LE = Less effective

*Note: ME, EF and LE are derived from the students’ performance and not from this analysis.*

**Figure 10. Item map showing locations of teachers and CLOS-R teaching practices**
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<tr>
<td>-2.6</td>
<td></td>
</tr>
<tr>
<td>-2.7</td>
<td></td>
</tr>
<tr>
<td>-2.8</td>
<td>Rapport</td>
</tr>
<tr>
<td>-2.9</td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>-3.1</td>
<td></td>
</tr>
<tr>
<td>-3.2</td>
<td></td>
</tr>
<tr>
<td>-3.3</td>
<td></td>
</tr>
<tr>
<td>-3.4</td>
<td></td>
</tr>
<tr>
<td>-3.5</td>
<td></td>
</tr>
<tr>
<td>-3.6</td>
<td></td>
</tr>
<tr>
<td>-3.7</td>
<td></td>
</tr>
<tr>
<td>-3.8</td>
<td>Credibility</td>
</tr>
</tbody>
</table>

Figure 11. Example of probabilities of demonstrating particular practices for the individual teacher 1EFG
2.4 Summary

The classroom observation phase of the study used a revised version of the classroom Literacy Observation Scale, CLOS-R, to explore the relationship between value-added estimates of student growth and teachers’ classroom literacy teaching practices. CLOS-R differs from CLOS (Louden & Rohl, 2003) in that it includes additional practices appropriate to the Pre-primary context (such as oral language), and the consolidation of CLOS practices that the empirical experience of In Teachers’ Hands suggested should be combined.

Rasch analysis showed the CLOS-R scale to have excellent psychometric properties in terms of its validity and reliability. A new coding manual was developed (see Appendix 3), to ensure high inter-rater reliability across coded video episodes.

A one-way ANOVA indicated statistically significant differences between the CLOS-R scores of the more effective, effective and less effective groups, suggesting that teachers grouped on the basis of children’s high, average or low growth in literacy scores can be expected to demonstrate more or less of the teaching practices measured by CLOS-R.

A Rasch analysis of the correlation between the teaching behaviours measured by CLOS-R and student growth in literacy measured by LLANS literacy assessments showed a very good fit to a simple linear regression line of best fit (a Pearson product-moment correlation of $r = 0.93$). That is, the study has demonstrated a strong and approximately linear relationship between teaching practices and student growth.

Further, an analysis of the correlation between teaching practices and residuals from the hierarchical modelling of student growth data indicated that variation in teaching practices accounted for the majority of variance in student growth that was not accounted for by prior performance, disability, interruption to learning or relative attentiveness. This analysis estimated that variation in teaching practices accounts for approximately 0.87 of the variance among these residuals. This proportion of variance may be thought an over-estimate on the grounds that teachers were selected to represent three groups rather than being randomly sampled; alternatively, the proportion of variance may be thought to be an under-estimate on the grounds that, in principle, measurement error must limit the amount of variance that can be explained by observations of practice.

Rasch modelling of the CLOS-R data confirmed that the CLOS-R data can be used to produce an interval-level measurement scale. The separation index was 0.92, indicating that the data fitted the model well. A more refined analysis of the same data, in which scores were summed across episodes for each teacher correlated almost perfectly with the former analysis, indicating that either was appropriate for use in the research. The Chi-square test of fit reported by RUMM2020 indicated a sound level of fit between the CLOS-R data and the Rasch model.

Substantively, analysis of the CLOS-R data in conjunction with the evidence of student growth suggests that there is a continuum of development in teaching practices. There are some low-level practices that all teachers demonstrated to some extent, some that many teachers demonstrated from time to time, and some that only teachers with the highest student growth scores demonstrated in their classrooms. Prospectively, then, if the educational goal is to improve rates for student growth in literacy, the path to improvement seems to be to increase teachers’ capacity to use the teaching practices associated with moderate-growth and high-growth literacy achievement.

A selection of these practices, and the differences among the ways in which teachers used them, are the subject of Phase 3 of this study.
3. LITERACY PHASE 3: CLASSROOM OBSERVATION - QUALITATIVE ANALYSIS

3.1 AIMS

This section of the report addresses the qualitative relationship between teacher effectiveness and classroom practice. It describes the methodology of pair-wise analysis that was chosen to provide a highly innovative and structured approach to qualitative analysis, and the selection of particular CLOS-R practices that were analysed in detail. It then describes the qualitative scales that were developed for each of these selected practices, with annotated examples from teachers located at various levels on each scale. The implications of the results of these analyses are interpreted in terms of suggestions of ways in which teachers may develop and extend their classroom practice.

The following questions are addressed:

- Are there qualitative differences in teachers’ use of the literacy practices: Oral Language, Explanation Word, Explanation Sentence, Explanation Text, Oral/Written Language and Metalanguage?
- Can a scale for each literacy practice be developed to show the range from less effective implementation of the practice to highly effective implementation of the practice?
- What is the relationship between the quality of implementation of each practice and student growth?
- Can information such as this provide detailed understandings about what constitutes more effective teaching?

3.2 METHODOLOGY

Results of the quantitative CLOS–R analyses allowed examination of the frequency of observed literacy teaching practices used by more effective, effective and less effective teachers. In order to examine qualitative as well as quantitative differences between teachers in their implementation of particular teaching practices we undertook additional analyses. The *In Teachers’ Hands* report had provided some preliminary information about the overall quality of CLOS teaching practices. For this study it was decided to make more detailed qualitative analyses of practices from one dimension of CLOS-R: the chosen dimension was Knowledge, as the Knowledge practices have a specific focus on the content of literacy teaching and they have been expanded from the original version of CLOS that was used in the analysis of the *In Teachers’ Hands* study. The practices selected for detailed qualitative analysis were Explanation Word, Explanation Text and Metalanguage that were in the original CLOS, and Explanation Sentence, Oral Language and Oral/Written Language that are additional in CLOS-R. The methodology of pair-wise analysis was chosen in order to make a fine-grained analysis of these practices that allowed for exploration of the question of possible differences between groups of teachers identified as more effective, effective and less effective, in terms of the quality of particular observed literacy teaching practices.

3.3 PAIR-WISE COMPARISONS OF LITERACY TEACHING PRACTICES

The methodology of pair-wise comparisons is derived from a method originally conceived and articulated by Thurstone (1927) that has not been widely used in education, and to the researchers’ knowledge, not with video data as the stimuli. This methodology was used to develop a scale for each selected practice as it was hypothesised that if it were possible to develop such scales, it would be possible to examine qualitative differences between the ways in which teachers implement the literacy teaching practices. Accordingly, pair-wise data were collected from judges’ comparisons of pairs of teachers’ performances in relation to each selected teaching practice. Judges recorded the performance perceived as the ‘better’ in each pair.

All episodes that had been coded as containing the selected practices were inspected. Table 15 shows the frequency for each teacher across the 10 coded episodes for each of these practices. It will be seen that some teachers did not demonstrate some of the practices, in which case these teachers could not be included in the analysis for these particular practices.
Once all examples of each practice within each teacher’s ten 12-minute episodes had been inspected one example that was considered to best represent each teacher was selected for pair-wise analysis. It is noted that the selected examples for each practice were contained within the 12-minute episode and only the part of the episode that clearly showed the particular practice formed the example. The examples, therefore, were necessarily of different lengths; some were only one minute or so in length, others were several minutes long.

Table 16 shows the numbers of examples of each practice that formed the item bank for the analysis and the numbers of necessary comparisons. It will be seen that the analysis included an example from all 19 teachers of Explanation Word, Metalanguage, Oral Language and Oral/Written Language and examples from 15 teachers for Explanation Text and Explanation Sentence. Accordingly the number of comparisons for each practice varied from 171 to 105.

### Table 15

Frequency for each teacher across the 10 coded episodes for the practices selected for pair-wise analysis

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Explanation word</th>
<th>Explanation sentence</th>
<th>Explanation text</th>
<th>Metalanguage</th>
<th>Oral language</th>
<th>Oral / written</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ME1</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>51</td>
</tr>
<tr>
<td>PME2</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>52</td>
</tr>
<tr>
<td>PME3</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>46</td>
</tr>
<tr>
<td>1ME4</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>PME5</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td>1ME6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>7</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>PME7</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>PEF1</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>10</td>
<td>36</td>
</tr>
<tr>
<td>PEF2</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>PEF3</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>1EF4</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>1EF5</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td>1EF6</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>PEF7</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>1LE1</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>PLE2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>1LE3</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>PLE4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>PLE5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Mean</td>
<td>6.05</td>
<td>3.05</td>
<td>3.90</td>
<td>7.00</td>
<td>4.70</td>
<td>7.00</td>
<td></td>
</tr>
</tbody>
</table>

Table 16 shows the numbers of examples (items) and comparisons for pair-wise analysis:

<table>
<thead>
<tr>
<th>Practice</th>
<th>Examples</th>
<th>Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanation word</td>
<td>19</td>
<td>171</td>
</tr>
<tr>
<td>Explanation sentence</td>
<td>15</td>
<td>105</td>
</tr>
<tr>
<td>Explanation text</td>
<td>15</td>
<td>105</td>
</tr>
<tr>
<td>Oral language</td>
<td>19</td>
<td>171</td>
</tr>
<tr>
<td>Oral / written language</td>
<td>19</td>
<td>171</td>
</tr>
<tr>
<td>Metalanguage</td>
<td>19</td>
<td>171</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>894</td>
</tr>
</tbody>
</table>
Each video example with connected transcript for each practice was entered into the Artichoke Pair-wise program (Fetherston, 2007). Figure 12 shows the layout of a working window of the program.

Each of the 894 pairs was assessed by a panel of five or six ‘judges’, all of whom had expertise and experience in early childhood and/or primary literacy teaching. It was composed of four members of the research team, an early years teacher and an expert in pair-wise comparisons and literacy benchmarking. Judges were presented with the examples of each particular practice two at a time and asked to judge which of the two better represented the practice in terms of the definition and examples from the CLOS-R coding manual. For each practice every example was paired with every other example of the same practice.

Analysis of the pair-wise data

The format for pair-wise data analysis is shown in Table 17. A response \( x_{ji} = 1 \) indicates performance \( j \) was judged a better performance compared to item \( i \) and a response \( x_{ji} = 0 \) indicates item \( j \) was judged a weaker performance compared to item \( i \).

Data collected in the pair-wise format were analysed using the Bradley-Terry-Luce (BTL) model (Bradley & Terry, 1952; Luce, 1959), which is usually stated in the following form:

\[
Pr \{X_{ji} = 1\} = \frac{exp \left( \delta_j - \delta_i \right)}{1 + exp \left( \delta_j - \delta_i \right)}
\]

<table>
<thead>
<tr>
<th>Table 17</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pair - wise data collection format</strong></td>
</tr>
<tr>
<td><strong>Judge</strong></td>
</tr>
<tr>
<td>Performance</td>
</tr>
<tr>
<td>Judge 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Judge 2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Judge P</td>
</tr>
</tbody>
</table>
In this context, Equation (I) constitutes a statement of the probability that item \( j \) is judged more difficult than item \( i \) in a pair-wise comparison between the items. Andrich (1978) showed that the person parameter is eliminated experimentally in the pair-wise design. In the context of the study, this means that the judges’ own personal disposition to the teaching practice, or their disposition to be lenient or harsh in their judgement of the teaching practice is eliminated. Instead the methodology provides information about the judgements of the relative qualitative differences between the teaching practices.

Analysing the data in this way provides empirical scales of each episode’s location. The episode judged to be the better over all pair-wise comparisons has the highest location. Conversely, the episode judged to be the weaker over all comparisons has the lowest location. Empirical scales are displayed graphically as item maps.

### 3.4 Pair-Wise Findings About Selected CLOS-R Practices and Teacher Effectiveness

Findings from the pair-wise analysis for the selected Knowledge dimension practices, that is, Oral Language, Explanation Word, Explanation Sentence, Explanation Text, Oral-Written Language, and Metalanguage are now presented. Results for each practice are introduced with a brief review of the importance of the practice to early literacy teaching in terms of established research literature and a summary of the frequency of the practice for each teacher group.

Results of the pair-wise analysis for the practice are then presented in an item map that shows the location of each teacher’s example from lowest to highest. In order to preserve confidentiality for teachers they are identified only by group, that is, more effective, effective and less effective. The item map is discussed in terms of observed similarities and differences between the implementation of the practice for teachers at different locations on the item map. Transcripts of examples, or extracts from examples, of teachers at higher locations are analysed in detail. As the focus of this project is effective teaching, descriptions of the examples from the less effective teachers are usually at a fairly general level.

The conventions used in the transcripts are outlined in Table 18 below.

### Table 18

**Conventions used in the transcripts**

<table>
<thead>
<tr>
<th>S</th>
<th>Student speak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ss</td>
<td>Student speak</td>
</tr>
<tr>
<td>E</td>
<td>Teacher and most of class speak</td>
</tr>
<tr>
<td>T</td>
<td>Teacher speak</td>
</tr>
<tr>
<td>[Stage direction]</td>
<td>For example [inaudible] or [laughter]</td>
</tr>
<tr>
<td>( [S] )</td>
<td>Indicates the length of a pause of 3 seconds or more</td>
</tr>
<tr>
<td>...</td>
<td>Indicates a pause of less that 3 seconds</td>
</tr>
<tr>
<td>//</td>
<td>Overlapping speech</td>
</tr>
<tr>
<td>( / e e /; / a r / )</td>
<td>Phonemes that are being sounded or articulated together are italicised and enclosed within slash marks e.g. / qu /, / str /</td>
</tr>
<tr>
<td><code>elephant</code></td>
<td>Words being focused on or studied are in italics; the words might be seen on the board or elsewhere</td>
</tr>
<tr>
<td>R ; B</td>
<td>Letter names being discussed are in capitals</td>
</tr>
<tr>
<td>‘Once upon a time there was’</td>
<td>Text read aloud is italicised and enclosed in inverted commas</td>
</tr>
</tbody>
</table>

### Oral Language

*The teacher focuses on the development of children’s oral language*

Oral Language, which did not appear in the original version of CLOS, has been added to CLOS-R to examine the speaking and listening environments of early years classrooms. In order to become print literate young children need to be able to transfer their knowledge of oral language to its written form. Comprehension of written text is highly dependent upon a reader’s oral language abilities, particularly with regard to word meanings and the syntactic and semantic relationships between them (Snow et al., 1998). Elements of oral language that have been identified as predictors of success or failure in early reading include verbal memory, particularly for sentences and stories, lexical skills, including speed of speech production and expressive and receptive vocabulary, and phonological awareness (Snow et al., 1998).
In addition to identifying language predictors of later literacy, research has also identified characteristics of oral language classroom interactions that are associated with high literacy outcomes for students. Some research has identified the amount of time spent in teacher-child/children oral interactions that engage children in extended conversations where children are encouraged to explore ideas through clarification and expression of thought (Dickinson, 2001). Other research has looked specifically at the nature of classroom talk around text (usually the narrative genre) and how the teacher structures this talk. The complex nature of such oral language interactions in the classrooms of effective teachers suggests that they contain ‘thoughtful talk’ about important ideas in a text where the teacher deals skillfully with children’s responses, ‘aiming to get children to explain, elaborate, and connect their ideas’ (McKeown & Beck, 2006, p. 281-294). It seems that such interactions are an essential component guiding children to make sense of decontextualised language, need much scaffolding to establish in the classroom and require the teacher to attentively and actively listen to the content and form of children’s responses.

In the frequency analysis Oral Language was observed in 89 of the 190 coded episodes. It was observed at least once in the classrooms of all teachers. The number of episodes in which it was observed for individual teachers ranged from a maximum of 10 to a minimum of 1. The mean score for the more effective teachers was 7.86, for the effective teachers the mean score was 3.43 and for the less effective teachers the mean score was 2.0 out of a possible total of 10.

Figure 13 shows the results of the qualitative analysis. The Oral Language item location map shows the examples from five of the more effective teachers spread along the upper end of the scale, with the other two more effective teachers located just below the middle. The less effective teachers’ examples are spread along the lower part of the scale, with examples from the effective teachers largely dispersed near the middle.

![Figure 13. Oral language: item map showing locations of teachers' examples](image)

**Oral language locations 1.5 To 3.5**

The examples of four of the more effective teachers that were located at the highest points on the item map all demonstrated very high levels of oral language teaching and learning within a meaningful context of thematic prior learning.

Megan’s class has been studying the theme of Fairy Tales. In the example below, a group of children are performing a dramatisation of *Goldilocks and the Three Bears*. As preparation for this oral language activity, over several days Megan has read different versions of the story, some in big book format. She has organised the children into groups of five, and nominated a narrator for each group. The children have decided which parts they will perform and have rehearsed their play. Megan has spent time with each group during this preparation, ensuring that children are on task and able to work together. Reconstruction of a well-known story through dramatisation

<table>
<thead>
<tr>
<th>3.5</th>
<th>More effective teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Effective teachers</td>
</tr>
<tr>
<td>2.5</td>
<td>Less effective teachers</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>-0.5</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>-1.5</td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>-2.5</td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>-3.5</td>
<td></td>
</tr>
</tbody>
</table>
You were doing a very good job when you were practising before though…

This is called Goldilocks and The Three Bears. Once upon a time there lived three bears in the woods. There was a big… the porridge was much too hot so they went for a walk in the, in the… woods.

Along came Goldilocks.

Along came Goldilocks and she saw a house. She wondered who it was. She wondered who it was so she went inside and she saw the porridge on the table. She tasted the big bowl but it was much too hot. Then she tasted the middle bowl but it was… much too hot too. Then she tasted the middle sized, the smaller bowl but it was just right so she ate it all. Then she went into the dining… the dining room. She sat on the big chair but it was much… it was much too hard. So she went on the middle chair but it was…but it was…

T: Too wide.

SNar: Too wide. So she went on the, on the small chair but it was just right so…

T: It broke.

SNar: But then…

T: The chair broke.

SNar: The chair broke. [twists fingers and moves from foot to foot]

T: Stand still please. Good girl, you’re doing a very good job.

SNar: She went in to…

T: The bedroom.

SNar: To the…

T: Bedroom.

SNar: To the bedroom and there was a big bed for Pop, Poppa Bear but it was much too big… hard. She went on to a middle sized bed but it was much too soft so she went on to a smaller bed but it was just right so before long she…she… was fast asleep.

T: Good girl

SNar: After that the bears came back.

S: Someone’s been eating my porridge.

S: Someone’s been eating my porridge.

S: Someone’s been eating my porridge.

SNar: Then they went into the dining room.

S: Someone’s been sitting in my chair.

S: Someone’s been sitting in my chair.

S: Someone’s been sitting in my chair and it’s broken.

SNar: After that they went into the bedroom.

S: Someone’s been sleeping in my bed.

S: Someone’s been sleeping in my bed.

S: Someone’s been sleeping in my bed and there she is.

T: Taleah, what happened now, who woke up?

SNar: Goldilocks woke up. She saw the three bears and she ran, ran towards the… and the bears chased her into the woods.

T: I’ll save you Goldilocks. Well done. Give Taleah and all the actors a big clap. Bow to the audience Taleah, you did a very good job darling. Good girl, really good job. Last group, last group.

SNar: Someone’s been eating my porridge.

In this example, the narrator is a child who has little self confidence and some language difficulties. Megan provides focussed and targeted scaffolding and feedback for her throughout the performance. Megan appears to be acutely aware of when she needs to intervene to provide support, for example by prompting the beginning of a sentence, and when it is appropriate to allow the child some time to think and to keep going at her own pace. Although this oral language task is highly challenging for this particular child, she is able to complete the narration with increasing confidence because of the warm support from Megan. Later, at the conclusion of all performances, Megan asks the class to give each other some positive feedback, and the other children acknowledge and praise this particular child’s efforts.

In the other examples from the more effective teachers at these locations on the scale there is a strong focus on understanding content, as well as on completion of tasks. The content is always substantive, for example, science-based classification vocabulary, and it is based within a broader
theme or learning sequence, as in this extract that focuses on the attributes of insects:

T: Sometimes you can't see the three body parts because they have the wings covering up. Matthew?
S: Camouflage.
T: They're very good at camouflaging.
S: Jaws.
T: Yes they do have jaws. They have a…?
E: Proboscis.

These more effective teachers have a clear sense of the purpose of oral language activities and their students demonstrate understanding of this purpose in their responses and in task completion. There is also an emphasis on the oral expression of the children, on what is being expressed and also how it is expressed.

In the extract below, the children in Elizabeth's class are playing a game in which they are required to provide clues so that a selected child can guess a particular Australian animal being described. This game is just one activity related to a class theme about Australian animals that is strongly related to scientific understandings (classification and description of animals), and requires children to analyse, synthesise and evaluate information in order to express it in the form of a statement. In her feedback Elizabeth accepts, models and corrects children's responses.

T: Can you think of a clue? Daniel?
S: It can um jump real, real high.
T: It can jump really high. Hand up. Lovely you've got your hand up Ryan?
S: It can croak.
T: Beautiful clues.

In another example of an oral language game, this time from Gill's classroom, a child is required to ask closed questions of his peers in order to gain information that will help him identify a target animal. The cognitive and linguistic requirements of the task are high and include a strong auditory memory component and using language for reasoning, in that the child needs to remember all information given to him, make sense of it, recognise what more information he needs in order to identify the animal and then formulate a closed question that can elicit this information. Gill provides scaffolding to help the child frame his questions and reviews and synthesises the information he has been given. In addition, she is aware that this child has some difficulties with his hearing so she faces him to make eye contact, and clearly articulates the information he needs in order for him to formulate his next question. She carefully monitors the pace of the activity, allowing some time for thinking, but also moves the child towards the solution.

T: All right, you're so clever I'm going to put some animals on there you haven't seen. Aha. Right Kieran put it on [places a headband containing a picture of a pig on the child's head so that he can't see it], Right. OK Kieran. And Eva's [got] the first question. Sshh.
S: Has it four legs?
S: Yes… [hesitates]
T: Ask Hamish. Better find out what size you are.
S: Is it small?
S: No.
T: Ask about your tail?
S: Does, does it have a tail?
S: Yes… um... er
T: Get some more information about your tail, long tail, short tail, what do you think it might be? [child hesitates] You have to ask him one or the other.
S: Travis is it a long tail?
S: No.
T: Not a long tail. Get some more information about your tail. Is it a hairy tail or a skinny tail, straight tail?
S: Is the tail skinny?
S: Yes.
T: Yes, skinny tail. Better ask her now is it straight or is it a curly tail?
S: Eva is it straight?
S: No.
T: No. It's a skinny tail and it's not straight and you're big and you've got four legs. Do you think you know what you are yet? Where do animals live?
S: On farms.
T: They could live on a farm, they could live in the bush, better find out. Better find out where you live. [child hesitates] Did you hear what I said? I know you're not hearing very well. Find out if you live on a farm or in the bush so what question are you going to ask him?
S: Angus do I live on a farm?
S: Yep.
T: Yes. Now this is the information you have, it's big, it has four legs, it has a short thin tail and it lives on a farm.
S: It's got a curly tail.
T: Oh now he's giving you some information. He said he's got a curly tail. What might it be? Curly tail, four legs, big, lives on a farm. [children call out] Don't give him any more
of 1-10. In this way, she is able to determine the emotional state of the children, some of whom are from challenging backgrounds. The children are asked to justify their feelings and articulate their reasoning, both of which require high levels of thinking. This personal conversation demonstrates high levels of respect, trust and understanding between the teacher and children.

T: Annemarie, how’s your day?
S: Ten.
T: Ten. Why are you having a ten day today?
S: Because I was having the most happy dreams.
T: Happy dreams, oh well done. I like to have happy dreams. How about your day Brendon?
S: I’m a ten.
T: A ten, even though you’re going to daycare you’re still having a ten today? That’s good.
S: I go in the spa today.
T: Wow excellent.

**Oral language lower locations**

At lower locations activities tended to be isolated rather than part of a sequence of learning, ‘We’re going to start off the morning with a game.’ Although the children were required to use oral language as a part of the activity, its development was not usually the focus. Tasks did not provide for differentiation amongst children or the explicit teaching of oral language concepts, such as vocabulary or sentence structure.

In terms of the skill of listening children usually appeared to have the choice of engaging or opting out without a significant impact on the lesson outcome and the teachers’ responses sometimes showed a lack of careful listening on their part. Children’s responses were usually accepted regardless of whether they took the form of single word utterances or simple sentences. Teachers had low expectations of children’s performance and participation, ‘Don’t forget you can pass,’ for both speaking and listening.

Some examples at lower locations focussed on the development of phonological awareness, particularly alliteration. Children were asked to articulate words beginning with a particular letter or sound. Other examples showed teachers modelling the use of a simple sentence, ‘This is a…’ Which children repeated or recast. Whilst these activities had the potential to extend children’s oral language, their teachers provided little feedback that could help extend their ideas or further develop their oral language.

At the very lowest locations activities had no explicit outcome so that the purpose was unclear. Whilst the opportunity to use oral language may have been present in activities, there
was little attention to the development of children’s language. Teachers appeared to have low expectations of what children could do, all contributions were acceptable whilst errors or misconceptions were often ignored. There was a lack of active listening by both teachers and children, in some cases there was little teacher participation and limited support in terms of scaffolding or feedback.

Summary

In the frequency analysis, the teaching practice of Oral Language, defined as the teacher focuses on the development of children’s oral language, was observed in just over three-quarters of the episodes of the more effective teachers, in one third of the effective teachers’ episodes, and in one fifth of the episodes of the less effective teachers. It was surprising that in early years classrooms, where children’s literacy skills were still emerging, there were so few opportunities for the development and extension of oral language in the classrooms of the effective and less effective teachers. Whilst there was a great deal of talk in these classrooms much of it did not seem to have the potential to significantly impact on children’s language learning.

On the other hand the development of oral language was part of an overall sequence of learning for the more effective teachers. For those located at the upper end of the scale oral language tasks were frequently integrated into a theme, with a specific focus on developing related discourses that included content-specific vocabulary.

These more effective teachers engaged children in extended discussions where children were scaffolded in extended, thoughtful conversations with other children as well as with the teacher. Sometimes these conversations took the form of a game, where children were required to provide clues, ask questions, or make informed answers. Such tasks required the children to use active listening skills to remember information, analyse, synthesise and evaluate this information in order to transform it into a different linguistic form, so that verbal memory, vocabulary, speaking and listening skills could be extended. Children in these classrooms were encouraged to use different types of sentence structures, such as simple and complex statements and open and closed questions.

These teachers introduced their children to a variety of discourses and situations in which oral language performance skills were developed and extended. Tasks included dramatising stories, discussion around texts and high level oral language games. It was clear that these teachers were highly engaged in classroom oral language activities as they provided targeted support to children, based on their sustained active listening to the content and form of children’s responses.

Explanation word

The teacher clearly explains specific word, letter or sound strategies or concepts

In order to be able to read and write effectively, young children need to develop the knowledge and strategies necessary to break the code of texts (Luke & Freebody, 1999). However, the ways in which this code breaking is taught and in particular the explicitness with which it is taught has caused continuing divisions in the educational arena (Chall, 1967; Snyder, 2008), particularly for young children (Fox, 2001). Nevertheless, there is a growing recognition within the education community that the explicit teaching of sound-letter relationships and how to use these in reading and writing are necessary parts of early literacy teaching (Rowe, 2005; DETWA, 2006). Snow, Burns and Griffin (1998) call for a strong focus on explicit instruction and practice with sound structures that lead to phonemic awareness… sight recognition of frequent words [and] instruction in spelling-sound correspondences and common spelling conventions, and their use in identifying printed words’ (p. 194).

It is important to teach young children word level foundational knowledge in the early years of school ‘before too many demands are placed on them by formal reading instruction’ (Ehri & Roberts, 2006, p. 127). Results of the US National Reading Panel research (2000) showed that phonemic awareness (awareness of the sound units of language) and letter knowledge measured at school entry were the two best predictors of reading success in the first two years of school and that systematic phonics instruction, in which the acquisition of sound-letter correspondences and their use in reading and spelling were explicitly taught, was highly effective in promoting early reading. Phonics has been described as ‘an umbrella term that stands for many forms of instruction that help children realise the alphabetic principle through instruction that links letters and sounds’ (Juel, 2006, p. 422).

Further, the components of phonics have been defined as ‘teaching sound-symbol correspondences directly, having children manipulate sounds in words through spelling tasks, pointing out patterns in similarly spelled words, or anything else which helps children learn about orthographic patterns in written language’ (Stahl, 2001, p. 335).

In the frequency analysis Explanation Word was observed in 115 of the 190 coded episodes and was observed at least once in the classrooms of all teachers. The number of episodes in which it was observed for individual teachers ranged from a
The maximum of 10 to a minimum of 1. The mean score for the more effective teachers was 8.3, for the effective teachers the mean score was 5.9, and for the less effective teachers the mean score was 3.2 out of a possible total of 10. It will be seen in Figure 14 that teachers' examples were widely spread across the scale from -4.0 to 5.0. Five of the more effective teachers were at the highest locations on the scale and four of the less effective, along with one more effective teacher, were at the lowest locations, with the effective teachers mostly around the middle of the distribution.

![Figure 14. Explanation word: Item map showing locations of teachers' examples](image)

The teachers addressed a variety of phonic concepts in a variety of ways. The more effective teachers at higher locations on the scale embedded their phonics teaching within a context that connected past with current knowledge and was contextualised through inquiry or theme work.

**Explanation word: location 5.5**

Elizabeth, a more effective teacher, is working with a small group of children, using their story writing as a starting point for a study of base words and word endings. She looks at one child’s writing and asks a question about the content that will lead into a mini-lesson about the spelling of the word *call* and the use of the word ending *ed* to signal the past tense. In this abridged example she uses children’s spelling errors to extend their existing knowledge about spelling strategies, using known resources.
T: OK. Now can you think about Blakes's story. What did the emu do, what did they do when the emu broke his leg?
S: Called the flying doctor.
T: Called the flying doctor, fantastic. Now hang on, we need to write the word, the base-word first so what is the base-word?
S: Call.
T: Can you stretch it out for me?
E: /k/ /l/ /l/. [T holds up 1 finger for each phoneme as they sound out the word]
T: Hang on. Take off the word ending. What is the word ending on this word?
S: E D.
T: Take that off, just tell me the base-word. Are you ready Jackson? Just pop the lid on Jackson because you need to listen. Ready. Listen. Call, stretch it out.
Ss: /k/ /l/ /l/.
T: Oh how are we going to spell it? That's quite a hard word for us to spell.
S: Does it start with K?
S: It starts with C.
T: Might... Hang on, I know a word on the THRASS chart that sounds a little bit like call, maybe we could use it.
S: Duck.
T: Duck and call, do they sound the same? I tell you what, it's on the vowel side and it's at the bottom and it's in the all box.
Ss: Ball.
T: OK think about it, say the word call for me.
Ss: /k/ /l/ /l/.
T: Hey, call, ball. Do they sound the same?
Ss: Yes.
T: Oh fantastic. Sounds like ball but it starts with /l/. OK, see if you can write it. And we'll have to decide whether it's a C or a K won't we?

[break in transcript as children write the word call on small white-boards deciding on C as the first letter]

T: Does it just look like ball but starts with a different letter? OK, can you add the word ending now to make the word called? Can you add the word ending to make the word called? Is it E D, called? Well done. Oh fantastic. So if you were the teacher... [picks up child's writing book and draws children's attention to the picture of a sugar glider] Oh listen to this one. This story was Jackson's and he did really well. He had a sugar glider in his story and that's the sugar glider there. Can you see the sugar glider?

Here Elizabeth has been highly systematic in her teaching. She has begun with a mis-spelling of the word called in one child's writing to create a lesson for the group on the spelling of the base-word call and the past tense ending ed. She encourages the children to use the spelling strategy of stretched pronunciation in c-a-il. She directs the children's attention to the THRASS chart with which they are highly familiar from daily practice with this resource, to check the spelling of the similar sounding word ball. Once the children have correctly spelled call Elizabeth focuses their attention on the word ending, which they then write and she moves on to discuss a similar error in another child's writing so that the children can transfer their knowledge of the word called to spelling the word jumped.

Explanation word : location 3.5

Throughout the year Jennifer, another more effective teacher, has been systematically teaching her Pre-primary children letter and sound relationships. In the following example she makes connections to previous learning, 'Who knows which song we've been singing for /f/? Who can remember from kindy?' The lesson requires her children to sing the /f/ song, think of words that begin with a /f/ sound, and to help sound out the words as the teacher records them on the board. This activity provides children with opportunities for repetition and practice. Jennifer models segmenting of words as she writes them, a strategy that the children can use in their own writing. She draws their attention to word concepts, February. Is that our longest word so far or our shortest?, and letter awareness, I wonder how many letters there are in it?'

T: Now we've been learning about another new letter of the alphabet this week. Who can tell me which sound? Blake?
S: /f/.
T: /f/. Who knows which song we've been singing for /f/? Who can remember from kindy? I'll show you. [holds up picture of flies] What's that?
Ss: Fly swatting.
T: Fly swatting. Someone's swatting a fly and it says 'flies are flying' and you know how we sing that don't you? Are we ready? One two...

T: Beautiful. So I’ll put that up over here for today to remind us of our song and I’ve got our new chart to go on the writing centre wall. [holds up back of chart] I’m not going to turn it around yet because I want you to just think about as many /f/ words as you can that then we can write up on our chart.

Oh, I wonder how many of you will come up with different ones, really long words or short words. OK. Hands down for now. I’m just going to turn it around this way and I’ve got a picture on there. [turns around chart that shows upper and lower case F and a picture of a fish and puts it onto the easel] Mm. Let me see. George can you tell me something that starts with /f/?

S: Fish.

T: Fish. Can you help me sound out the word fish? So it will start with a …

S: /f/.

T: /f/.

S: We all know that it will start with /f/. [begins to write lower case F]

T: What do you hear about the /f/, /f/ /i/? [continues writing] And what’s at the end of fish?

S: /Sh/.

T: /Sh/. Good boy, fish. [writes lower case SH] So that’s a /f/ word. Well done. Joshua can you tell me another /f/ word?

S: Flower.

T: Flower. Do you think that’s a long word or a short word? Let’s sound it out. Can you help me sound it out? [begins to write] /f/, so it starts with a /f/. What do you hear after the /f/?

S: /u/.

T: Oh try again, /f/, /f/, /f/-ower. [writes letters to represent each phoneme as she sounds them with the children] What do you hear after the /f/-ower. Can you hear a /u/ /f/ /f/ /i/, /f/ and then we have the ower. What do you hear at the end, flow-er, flower. Have a look, it’s an E and a R for flower. Well done a /f/ word. Mikeala what’s another /f/ word?

S: /w/.

T: February. Now what’s special about February Mikeala. … Is it a name of something? Is it name of a …? It’s the name of a month isn’t it? And when we have the name of something what sort of letter do we use?

S: A capital.

T: A capital letter, good girl. Is this a capital F?

Ss: Yes.

T: It is. February is a pretty tricky word. Can you all help me to sound it out?

E: [teacher scribes as the word is sounded] /f/ /e/ /b/ /r/ /u/ /a/ /r/ /y/

T: February. Is that our longest word so far or our shortest?

Ss: Longest.

T: The longest word. I wonder how many letters there are in it? Shall we count them?

E: Yes. One, two, three, four, five, six, seven, eight. [teacher points to each letter as children count it]

T: Eight letters.

Elizabeth, Jennifer and the other more effective teachers at high locations on the scale taught word level concepts in highly systematic ways. They identified a sequence of word level concepts and skills and targeted their instruction to the developmental levels of the children, demonstrating a strong sense of purpose, that was clearly understood by the children, as indicated by their responses and levels of participation. Lessons were paced appropriately to allow children time to stop, think and consolidate learning.

These teachers demonstrated correct and consistent use of metalanguage, in particular, clearly differentiating between letter names and sounds. They carefully articulated letters, sounds and words to assist the children’s learning. Scaffolding was used to reinforce, support and extend learning. This was done through questioning and modelling at both individual and group levels.

T: Is this the same sound or different sound. Are you listening? Same sound or different sound. Listening. I’m going to ask Jacob. Are these the same or different? …

S: Different.

T: Listen I haven’t given you the sounds yet… /j/, /m/.

S: Different

T: Different. OK, this is out of five, /p/, /l/… Same or different?

S: Different

T: Different, well done… /m/, /m/.

S: Same.
words? Chiquita?

S:  A Q and a U.

T:  A Q and a U. Good girl. They all have the sound /qu/. Everyone say it.

E:  /qu/.

T:  So what two letters always have to go together when we have a /qu/, its friend that always, always, always goes with it is what? Isabelle?

S:  U.

T:  U. It does not go anywhere without its best friend U so they always have to go together in every word.

Within the context of a word level lesson, these more effective teachers often created a conspiracy of learning. Children were made to feel that the teacher was part of their team, and that as a group they were working together to achieve highly explicit phonics outcomes.

**Explanation word lower locations**

In examples at lower locations on the item map, word-level activities appeared to be independent of a sequence of literacy development, and not to fit within a broader context. Teachers were generally not explicit in their word level instruction, and did not specifically identify the word level concept being taught. Activities often lacked clear purpose, particularly when task instructions were insufficient and lacked clarity. In one example the children were introduced to a new activity that required them to move a counter into a box for each phoneme in a word, an activity that if carefully scaffolded has the potential to facilitate phoneme awareness. However, in this less effective teachers’ classroom the only instruction was, ‘So we’re just doing sounds. This is what we’re doing, we’re just making the sounds, OK.’

In several classrooms noise levels and general classroom organisation interfered with lesson delivery and task completion, particularly when precise auditory discrimination was required. This was exacerbated when teachers did not employ careful articulation of the particular words or sounds being studied. Use of metalanguage was not always consistent, particularly when referring to letters and sounds, and was sometimes confusing, ‘What sound, if we put A and P together what sound does that make?’ There was a general inefficient use of time, for example, children waiting for a length of time to get task direction from the teacher, or the teacher continually repeating the same information to different individuals around the room when this could have been used as feedback to the whole group. Also, there was generally a low level of teacher interaction and expectation and limited or no feedback that extended specific word level understandings. Scaffolding often focussed on task management, such as ensuring everyone had a turn, or on task completion ‘Where did you get the A from… You have to get your story written. Just start writing your story. Megan I want you to finish your story’. Such restricted learning provided little or no differentiation for children, and limited development of word level ideas and concepts.

**Summary**

All teachers taught word level knowledge and skills, but there were large differences in both the quantity and quality of this teaching. In terms of quantity, word level teaching was observed in most of the episodes of the more effective teachers, just over half of the episodes of the effective teachers and around one third of the less effective teachers’ episodes. The large differences in quality could be seen in the wide spread of example locations on the item map, that ranged from -4.5 to 5.5 logits. These qualitative differences were clearly evident in the observational analyses of the content and delivery of word level teaching.

The more effective teachers, who were located at the upper end of the scale, took a highly systematic approach to the explicit teaching of phonological awareness and phonics within the context of reading, writing and spelling. The more effective teachers made very clear connections between the sound structure of language and its written form. They were very clear and precise in their use of metalinguistic terms, particularly ‘sounds’ and ‘letters’, in their careful articulation of words and parts of words and in their explanations of rules, exceptions and definitions. When word level concepts were being taught children were highly engaged as they actively listened and participated in a variety of focused, motivating and purposeful learning experiences that were often related to other areas of the curriculum. These teachers also provided many opportunities for practice of learnt skills, using carefully structured sequenced programs of learning.

A particular feature of these teachers’ classrooms was that, whilst there may have been some low background noise, when they were making explicit the connections between spoken and written words, children with relatively normal
hearing were able to hear the teacher’s exaggerated articulation of sounds and words and also were usually able to see the teacher’s mouth.

The teaching of phonics and phonological awareness in the more effective teachers’ classrooms moved seamlessly between explicit teaching, guided practice and transfer of learnt knowledge, skills and concepts to new situations. These teachers challenged the children as they made clear their high expectations for engagement, demonstration of knowledge and skills, and completion of tasks to a high standard.

**Explanation sentence**

*The teacher clearly explains specific grammatical strategies or concepts*

Explanation sentence, which did not appear in the original CLOS, has been included in CLOS-R in order to identify teaching practices that address sentence level concepts and skills. It refers to grammatical knowledge and also related knowledge about punctuation (Wray et al., 2002).

Young children’s oral language ability that includes syntactic knowledge and skills has been shown to be strongly related to later reading acquisition (Snow et al., 1998) and children’s ability to manipulate and reflect on the grammatical structure of language (syntactic awareness) has been shown to be related to reading achievement (for a review see Bowey, 1994). This relationship, however, is not as clear as that between phonological awareness and reading (Bowey, 2005), and there has been much less published research in the area. It has been hypothesised that the ability to understand and manipulate sentence structures, when combined with phonological awareness, helps beginning readers make more accurate predictions about unknown words that they encounter within a sentence context (Rego & Bryant, 1993; Tunmer & Hoover, 1992; Cain, 2007). It has also been hypothesised that syntactic awareness would be related to reading comprehension, in that knowledge and use of sentence structure would help children integrate sentence- and text-level information (Bowey & Patel, 1988), although evidence for this has not, as yet, been established (Bowey, 2004; Cain, 2007).

Theories of child language development are also somewhat ambivalent on the topic of grammatical development, as is research into the explicit teaching of grammar. Whereas Piaget (1959) saw children as actively constructing grammar from their experiences, Vygotsky (1962) concluded that although very young children learn grammar unconsciously, instruction in grammar (and writing) helps children make a conscious focus on language. Research over many years into the relationship between the explicit teaching of grammar and improvement in children’s writing has not shown a strong relationship (Andrews et al., 2004; Snyder, 2008). Nevertheless, as grammar is being introduced into the national assessment system at Years 3, 5, 7 and 9 in 2008 it seems important to examine how it is being taught in early years classrooms.

In the frequency analysis Explanation Sentence was observed in 58 of the 190 coded episodes. The number of episodes in which it was observed for individual teachers ranged from a maximum of 7 to a minimum of 0. The mean score for the more effective teachers was 4.57, for the effective teachers the mean score was 3.43 and for the less effective teachers the mean score was 0.40 out of a possible total of 10 episodes. As Explanation Sentence was not observed in the coded episodes of four of the less effective teachers, these teachers could not be included in the pair-wise analysis.

It will be seen in Figure 15 that the examples from two of the more effective teachers are located at the upper end of the scale and most of the teachers, five more effective, four effective and the one less effective teacher are clustered around the middle. The examples from two effective teachers are located in the lowest positions.
The following example is located at 3.5, the highest position on the item map. Lyn, a more effective teacher is introducing a writing session by modelling the writing of a sentence on the board. As she writes, she explicitly and intentionally articulates the sentence level concepts she wishes to teach or reinforce for the children to use in their writing. Lyn has a very clear purpose for this lesson, with a strong focus on the sentence as a means of expressing ‘ideas’. With the children she creates an introductory sentence for a recount as she focuses on both form and content. Lyn makes use of carefully scaffolded questions to elicit information from the children as they refresh, verify or extend their knowledge and understanding. The children are active participants as they read, answer questions and demonstrate their understanding of sentences. This carefully structured sentence writing activity takes the form of a scaffolded introduction to the children’s own writing of a recount.

T: Let me see, when I am starting off my ideas for writing what do I have to remember to do Alicia?
S: You have to put a capital letter.
T: I certainly do. I start all my sentences with a capital but what are the ideas that I have to remember in my first sentence Olivia?
S: Who, what, where, how.
T: So we need who, what, where, how. [writes these words across top of board]

S: And why.
T: Sometimes why. There’s one that’s missing, who, what, where?
S: When.
T: When, good girl Tegan.
S: And feeling.
T: And sometimes our feelings, we can put our feeling into how and why as well. So if I start off my beginning of my idea my sentence, what do I start with? Jessica?
S: A capital.
T: A capital letter. OK, let’s have a look at my writing today. Here’s my capital letter to start with. [starts writing on board]
Ss: ‘On Sunday’.
T: Oh well done. ‘On Sunday’… Why did I put a capital letter there. Olivia?
S: Because it’s the name of the day.
T: It’s the name of the day. ‘On Sunday’… Oh I’ve got another capital letter.
S: ‘Fred’.
T: Why did I put a capital for Fred?
S: Because it’s the name
T: Because it’s the name, exactly. ‘On Sunday Fred// and I’…
Ss: ‘//’and I… took’.
T: ‘Took’.
Ss: ‘Honey’.
T: Who’s Honey? Who can remember who Honey is? Can you remember who Honey is Alicia?
S: Your dog?
T: It’s my dog. ‘On Sunday Fred and I took Honey’…
Ss: ‘For a walk to the’…
T: Oh see if you can guess this one, /b/, it’s going to start with /b/, it’s got the /ee/, listen, it’s got the /ee/ sound in it, it likes coming in the middle. What is the /ee/ sound? What is it Jason?
S: Beach.
T: We are going to have the beach. How do I spell beach with that /ee/ sound, what /ee/ sound would you choose?
S: /e/ and A.
T: Exactly, that one loves coming in the middle the most, beach. What sound comes on the end Olivia?
S: C H.
T: C H. Now that’s the end of my idea. ‘On Sunday Fred and I took Honey for a walk to the beach’, What do I have to do at the end of my idea Annie?
S: Put a full stop.
T: Annie?
S: Put a full stop.
T: Put a full stop. OK there’s my full stop. Let me see how I’m going. Have I got who?
S: Aha.
T: Who was it? Olivia?
S: Your dog.
T: It was my dog. Who else was it?
S: Fred.
T: It was Fred and who else was it?
S: You.
T: And me. What, what did we do?
S: You took Honey to the beach.
T: Right. That’s what we did. Where did we go? Jessica?
S: To the beach.
T: We went to the beach. Have I told you how?
Ss: No.
T: Do we always have to have how in our beginning sentence?
Ss: No.
T: Did I tell you why?
Ss: No.
T: Well a little bit, we went there to have a…
S: Holiday
T: No, to go for a…
Ss: Walk.
T: Walk. Exactly. Did I tell you when it was?
Ss: Yes.
S: On Sunday.
T: It was on Sunday. So I’ve got all of those things done in my beginning sentence.

This example, whilst it was part of a larger lesson on writing, was the only instance observed in the study of a teacher explicitly planning and delivering an activity specifically focused on sentence form and content. Other teachers also taught sentence level concepts within a larger context, but usually with a focus on other aspects of literacy.

**Explanation sentence: location 2.0**

In this example of Explanation Sentence, Elizabeth, another more effective teacher, has a broad focus on the characteristics of good authors. As Elizabeth scaffolds the children’s discussion, one child suggests that good sentence writing is one characteristic. Elizabeth accepts the child’s contribution and builds on it, briefly focusing on sentence level concepts that include punctuation, as important parts of text creation. As she discusses these sentence concepts one child appears to associate ‘describing words’ with the sentences of good authors, an idea that Elizabeth acknowledges. These exchanges from her classroom about sentences form part of a much larger guided general discussion on the features of good writing and how these features contribute to the construction of whole texts.

T: I’m wondering if you can remind me when good authors write what sort of things do they do, people who are really good authors, what sort of things do they do? Yes?
S: Put feeling.
T: Oh they put feelings into their writing. fantastic. Nathan?
S: They have good sentences.
T: Oh good, they have good sentences. Do they use anything special to show what a sentence is?
S: [Sound]
T: Sorry Nathan?
S: That, um…
T: How do they show a sentence? What do they use?
S: They use capitals and full stops.
T: Fantastic. Where would the capital go?
S: Um, at the start.
T: Right.
S: And, um, um, and after the full stop.
T: Oh yes, if you’re about to write a new sentence you’d start again with a capital letter. Good boy. Anything else that really good authors do when they write?
S: Describing words.
T: Oh yes they use lots of great describing words don’t they?

Explanation sentence: locations 1.0 to -1.0

In the examples from the more effective teachers at these locations there was some teaching about a sentence as a means of expressing information and conveying meaning. For example as she was teaching reading strategies Megan focussed on the idea that a sentence should make sense:

T: Read on to the full stop and then you think about what would make sense don’t you? What would make sense?

In the following example, another more effective teacher, focussing on meaning, requires the children to use sentences that include particular words encountered in their reading, asking them to apply known features of sentence structure. She focuses first on the word ‘angry’ and then moves on to ‘saturated’ as meaning very wet, and asks the children to repeat the word in a sentence.

S: Angry.
T: Can you tell me that in a sentence?
S: He is angry.
T: He is angry isn’t he? Oh I’m going to read and you can read back to me OK. Are we ready? ‘Mr Peacock got wet.’ Your turn.

Ss: ‘Mr Peacock got wet.’
T: ‘He got very wet.’ Your turn.
Ss: ‘He got very wet.’
T: Look how they’ve done very. It looks like it’s all wet doesn’t it? He got saturated. Can you say that?

Ss: Saturated.
T: Okay let’s say it in a sentence. ‘He got saturated.’ Your turn.
Ss: ‘He got saturated’.

In another example between these locations an effective teacher, during a handwriting lesson, asked children to ‘make a longer sentence than ‘Jelly beans jump.’ Several children then contributed to the sentence, ‘Jack juggles jelly beans’. In the other examples between these locations children were encouraged to use punctuation:

T: If that’s the end of your sentence you need a full stop.

Explanation sentence: lower locations

Examples from the lowest locations showed teachers referring very briefly to punctuation and oral expression. Where sentence level features in a written form were mentioned, they were limited to identifying instances of punctuation, such as full stop, capital letter, exclamation mark or question mark. There was little or no elaboration as to how these could be used to improve the children’s reading and writing:

T: These are telling us that…?
S: That someone’s talking.
T: That someone’s speaking. We’ll finish it tomorrow.

Oral examples required the children to express themselves in a sentence. Although the teachers modelled the structure of a simple sentence, for example, ‘This is a dog’, there was no feedback on how the children could recast or expand their sentences to make them more meaningful.

Summary

Of the six teaching practices selected for pair-wise comparisons, Explanation Sentence was the least frequently observed. It was observed in just under half of the episodes in the more effective teachers’ classrooms, in one third of episodes in the effective teachers classrooms, and was not observed at all in the coded episodes of four of the less effective teachers. The quality of sentence level teaching for two of the more effective teachers was clearly differentiated from the other observed episodes. There was a large cluster of teachers in the middle of the item map that was comprised of more effective teachers, effective teachers and one less effective teacher.

The observed examples of Explanation Sentence were all different from each other. The example at the highest location from the classroom of a more effective teacher showed the teacher focussing on both the form and content of a sentence. She explicitly taught how to structure a meaningful sentence in terms of the information it contained as well the punctuation and spelling required for the written form. This teacher modelled how to create a sentence that conveyed detailed information.
She kept the children actively engaged by questioning them about various sentence aspects such as ideas, words, spelling and punctuation. This questioning not only drew information from the children, but also extended their knowledge and understanding. When her sentence was complete, the teacher then checked the children's understanding of each element of the sentence. This sentence then became a model for the children's own writing. This was the only observed example that contained the planned explicit teaching of sentence structure and content.

As the observations took place towards the end of the school year, it is likely that other teachers had explicitly taught aspects of sentence form and content. There is evidence for this in the examples from some of the more effective teachers located around the middle of the item map. Children in these teachers’ classrooms volunteered information about the form and content of sentences, were asked to use sentences in oral language interactions, and were praised for using complete sentences in speech and for demonstrating correct punctuation in writing.

Whilst there were not many examples of the explicit teaching of sentence structure, apart from punctuation and this was usually limited to the placement of capital letters and full stops, the more effective teachers were frequently observed modelling the use of various sentence forms as they focussed on other aspects of language or classroom activities and procedures. Some of these have been coded as examples of Oral Language. In particular, in the oral language games that required children to use specific statement or question formats, the more effective teachers carefully scaffolded the children’s use of particular syntactic forms as they modelled and directed the children’s attention to both form and content.

The results of the quantitative analysis suggest a relationship between Explanation Sentence and teacher effectiveness in that the practice was more frequently observed in the episodes of the more effective teachers than in episodes of the effective teachers, and was not present at all in the episodes of the more effective teachers than in episodes of the less effective teachers, and was not present at all in the episodes of the more effective teachers. However, in the qualitative analysis Explanation Sentence did not clearly differentiate between the more effective teachers, effective teachers and less effective teachers (only one less effective teacher was coded as demonstrating this practice). These inconclusive results are in accord with previous research (see Bowey, 2004; Cain, 2007) that has failed to show a direct relationship between the explicit teaching of grammar and literacy learning. It may well be that the modelling and scaffolded use with feedback of syntactic structures for other literacy-related purposes is sufficient to develop grammatical awareness and use at this phase of schooling.

**Explanation text**

The teacher clearly explains specific textual strategies or concepts

The National Reading Panel (2000) attributes positive outcomes for students to methods used by teachers in which they ‘demonstrate, explain, model and implement interaction with students in teaching them how to comprehend a text’ (p. 4). This comprehension of text includes strategies with which to bring background knowledge of a topic to the text being read, to comprehend texts literally as well as inferentially, to comprehend words and to use comprehension monitoring and ‘fix-up’ strategies (Snow, Burns & Griffin, 1998). Many methods of comprehension instruction involve careful scaffolding of students until they have learnt a particular strategy (for example, Duffy, 2003; Duke & Pearson (2002); Palincsar & Brown, 1983). Making specific attributes of a text explicit does not only mean formal comprehension strategy instruction. It may mean embedding the teaching of reading and writing into a wider context, using whole texts as the basis for instruction (Wray et al., 2002).

Within the Australian educational context a broad view of what is involved in learning about text is current. The ‘four resources’ model of literacy proposed by Luke and Freebody (1999) has been widely accepted. This model involves learning about the four resources of decoding (that has a word level focus), participation in the meanings of text, functional use of text, and critical analysis of text that are learnt within a cultural context and are all seen as necessary, but not individually sufficient, for effective literacy in contemporary society. Also within the Australian educational context text is broadly defined. Whilst it has been traditionally defined as ‘meaningful units of written or print language’ (Lankshear, 1997, cited in Anstey and Bull, 2006), ‘the increasing range of technological innovation [has] produced a plethora of new forms of text’ (Anstey & Bull, 2006, p. 100). Accordingly, included in our definition of text is not only print, but also visual and multimodal texts.

In the frequency analysis Explanation Text was observed in 74 of the 190 coded episodes. The number of episodes in which it was observed for individual teachers varied from a maximum of 9 to a minimum of 0. The mean score for the more effective
teachers was 6.0, for the effective teachers the mean score was 3.6, and for the less effective teachers the mean score was 1.4 out of a possible total of 10. As Explanation Text was not observed in the classrooms of one effective and three less effective teachers, we were not able to include them in the pair-wise analysis.

It will be seen in Figure 16 that the examples of four of the more effective teachers are located at the highest positions of the scale, well separated from the examples of the rest of the more effective and effective teachers. The examples of the two less effective teachers who did demonstrate Explanation Text are located at the lowest positions on the item map.

Figure 16. Explanation text: item map showing locations of teachers’ examples

The more effective teachers often used whole texts to make specific attributes explicit when teaching both reading and writing. In the Explanation Text examples at high locations, teachers were seen using whole texts to address Luke and Freebody’s (1999) text-related resources, specifically those that helped children learn to participate in the meanings of texts, use texts functionally and critically analyse and transform texts.

**Explanation text: location 3.5**

In the following example, located at the highest level on the item map Vicki is preparing the children for a visit to the school library. Her P/1 class has been researching the human body, beginning with a discussion of what they wanted to find out. The research questions that the children wanted to answer are written on the whiteboard and frequently referred to by children and teacher, and a variety of non-fiction texts that have included ICT resources have been consulted. Today, Vicki has planned for the children to take part in the guided viewing of an episode from *The Magic School Bus* DVD that embeds factual information about the human body within a fictional format. Vicki begins by eliciting from the children a review of some of the processes they have used in their research, which include the use of a variety of information sources, a critique of texts and text types, and strategies for checking the validity of information.

**T:** What have we been doing in our research, what are the things we’ve oe?

**S:** Learning about the body.

**T:** How have we been doing that? That’s true.

**S:** Um, researching about the body.

**T:** How? What things have we done?

**S:** Going on Google and we’ve read in books.

**T:** We read in…did we read fiction books?

**Ss:** No.

**T:** Story tales?

**Ss:** No.

**T:** Did we read non-fiction books?

**E:** Yes.

**T:** Ones that looked like these? [holds up a factual text about the human body]

**E:** Yes.

**T:** Just one, was that enough?

**E:** No.

**T:** Why not? Why couldn’t we just read one book and that just be enough? James?

**S:** Because it wouldn’t tell us everything about
the body.

T: It couldn’t tell us everything could it? So, what’s another reason that we just don’t only read one book? Jack?
S: We…we…can’t read this one book.
T: You can’t read this book? Do you have friends read it with you?
S: Yes.
T: And Mum?
S: Yes.
T: And teachers? Why can’t we just read one book? It doesn’t tell us everything, Tony?
S: Um, it might not ans…answer all the questions.
T: Certainly might not answer all of our questions, Thomas?
S: And sometimes when you read a book about the human body, when…it’s…it’s when you read a book and it tells us about a body you, like, could read another book and it might tell the same.

T: Brilliant. Because if we’re researching can we just believe one person, one book?
E: No.
T: No, we need to find it in another book. [holds up another factual text about the human body] Sometimes we need to find it in three books [holds up another factual text about the human body] just really to make sure that the things that they’re telling us are true: We’re checking aren’t we? You guys are beautiful researchers.

Vicki carefully guides the discussion with clear purpose and direction, ‘What have we been doing in our research…who can remember?’ as she develops the children’s knowledge base through carefully scaffolded questioning. ‘Did we read fiction books…did we read non-fiction books?’ She moves them beyond factual knowledge to higher order reasoning, ‘Why couldn’t we just read one book and that just be enough?’ In this way she challenges and extends children’s thinking, ‘What’s another reason that we just don’t only read one book?’ The children are actively involved in the discussion, demonstrating clear understanding of the purpose and their ability to respond to the teacher’s challenge, ‘We can’t read just one book; you, like, could read another book and it might tell the same.’

Whilst she has carefully scaffolded this discussion to elicit much of the information from the children, Vicki draws this part of the discussion to a close by reiterating the main point, that it is important to consult more than one text in order to check the authenticity of information, ‘Can we believe just one person, just one book…we need to find it in another book…in three books…just to make sure the things they’re telling us are true…we’re checking aren’t we’. She concludes by explicitly praising the children for their research skills before they continue the discussion and view the DVD in the library.

In this example it is clear that Vicki is addressing the resources of the text and user as she questions the children about the types of texts they have read to locate information. She has also inducted them into the resource of critical text analyst as she helps them reflect on why they have used various sources to answer their questions.

In common with other more effective teachers located at high levels of the item map, Vicki has moved the children between factual and higher levels of text knowledge. All four more effective teachers at this location provided children with a carefully scaffolded lesson about features of texts. It can be seen in the following extracts that they taught children important reading strategies that could be transferred to other situations and texts. Lyn focuses on the structure of a non-fiction book, and how to use this structure to gain information.

T: [holding up a factual text and turning the pages] So if I looked at page twenty, there it is, it’s telling me all about beetles. There’s another page that I can look at like a contents page but it has a different name, who can tell me the other one? There’s another page in my book. Go on Jennifer, you’re bursting!
S: Index.
T: Good girl, it’s the index and I was going to tell you… Where would I find the index Hamish?
S: At the very back.
T: And what does the index tell us?

Elizabeth and Gill use fictional texts in order to focus on particular text features. Elizabeth reviews the elements of a narrative to scaffold the children’s own story writing.

T: Now what do stories have? When I was thinking about how I was going to write my story… What do all stories have? Have a look up here. [points to wall charts showing beginning, middle and end] Are you ready Ryan? Have a look up here? Someone with their hand up? Brittany?
S: A beginning, a middle and an end.
T: Fantastic, all stories have a good beginning, an interesting one so everyone wants to read it; they have a great middle and then an end.

In a viewing activity that follows the reading of the picture poetry book Each Peach Pear Plum Gill compares the connection between the illustrations and the text of two different picture books.

T: What made you look at the pictures? Why did you look at the pictures? Well we said in Handa’s Surprise the illustrator made
the pictures big, he made it close-up. Is this what the illustrator in this book [Each Peach Pear Plum] did or did the illustrator in this book do something different?

S: Did something different.

T: Well what did he do that was different?

S: He made them look a bit small.

Explanation text: location 0

This Pre-primary class has been studying the topic of the planets. In this example an effective teacher is nearing the end of a reading of the big book Postcards from the Planets. She discusses the book with the children as preparation for writing their own postcard from a planet.

T: [reads from big book] 'It's strange to think we'll be asleep for four months, Matt.' [Points to an illustration.] Up here it's not a postcard but there's some writing. I wonder if you can tell how you think they're talking to Aunty May. She says, 'Is that you Aunty May? It's great to hear your voice again. When I woke up we were already in earth orbit and now we can see the space-port just below us. See you at home tomorrow.' How would she be talking to Aunty May if she's on here [pointing to the book]? Brittany?

S: On the telephone.

T: On the telephone maybe. What else might they have? Brad?

S: A walkie talkie.

T: A walkie talkie or a radio. And here [turns the page and points to an illustration of a newspaper] is some more writing but it's not a postcard.

S: It's a newspaper.

T: It's a newspaper, good girl. And the newspaper is telling everyone back on earth that the space ship has landed safely with all the people inside so that means all these people that were writing postcards are safely back to earth after their big trip.

In common with the other teachers around this location this teacher uses questioning to check understanding of text level concepts and provides for some extension of children’s participation in the text, ‘How would she be talking to Aunty May if she’s on here?’. The teacher draws attention to several forms of text that contain ‘writing’ (speech bubble, post card and newspaper), although there is little elaboration on other features of these forms. Children are actively involved in the discussion, and are responsive to the teacher’s questions.

They are able, with some support from the teacher, to complete the associated writing task. In all episodes around this location, teachers explained information, concepts or text features at levels appropriate to the children’s literacy development.

Explanation text: lower locations

In examples that were at the lower end of the item map, teachers did not usually have a clearly articulated purpose for the task. Discussion of text was frequently limited to sequenced factual recall of text, where the children were questioned about the order of events, ‘What happened first in the story?’, and they responded with one or two word answers. Although children were usually attending to the task, there was little opportunity for analysis and extension of text level concepts. Task instructions were confined to presentation of work, such as left to right and top to bottom direction of text.

In these examples tasks were not at an appropriate level for the children; some were too easy, some were too difficult. The tasks focused mainly on procedural knowledge and, as there was little or no scaffolding, some children did not complete them as intended. Texts used by the teachers in these examples were confined to narrative picture books.

Summary

Teaching at the text level was less frequently observed than teaching at the word level. It was observed in over half of the examples in the more effective teachers’ classrooms, in one third of the examples in the effective teachers’ classrooms and around one seventh of the examples in the less effective teachers’ classrooms. It was not observed at all in three of less effective and one of the effective teachers classrooms. In terms of quality of text level teaching the examples of four of the more effective teachers were very clearly differentiated from the rest.

In the classrooms of these four more effective teachers there were very high levels of discussion around text that required high order thinking. It was clear, when the video observations were made towards the end of the school year, that the children were very familiar with a number of text types and were able to transfer this knowledge to new situations and make comparisons between different texts and text types, and to critically analyse texts. The text types chosen by teachers included a range of fiction and non-fiction texts within print, video and interactive media. When using non-fiction texts children were scaffolded to learn strategies for finding the information they needed, to consult a number of texts, and to question the authenticity of texts. When fiction was used they were required to make comparisons between the intentions of different illustrators and to focus on the elements
of narrative in order to guide their own story writing. Children were challenged to make use of the resources of text user, text participant and text analyst.

In general, the examples from the classrooms of the other more effective and the more highly located effective teachers still showed a strong emphasis on the structure of texts that was often related to a writing task. Further, children were required to reflect on text at levels above the literal, although there was not the high level of challenge that was observed in the examples from the four most highly ranked more effective teachers’ classrooms.

**Oral-written language**

_The teacher makes logical connections between oral and written language_

The Oral-Written Language teaching practice, that was not included in the original version of CLOS, has been added to CLOS-R to allow examination of the connections that teachers make for children between oral and written language. In order for young children to become literate they need to be able transfer their knowledge of oral language, which they have been learning informally and using for some years, to the written form that becomes the most important focus of formal teaching in the early years of school. It is important for teachers to make connections between these modes explicit in their literacy teaching as when literacy development is viewed from a systems perspective oral language plays an important part in organising cognitive and behavioural systems that support literacy learning (Nelson, 1996). There is evidence for the view that children learn more efficiently when they develop language and literacy concepts and skills together so that interconnections among systems can be fashioned into mutually reinforcing systems’ (Dickinson, McCabe & Essex, 2006, p. 12).

In terms of the aspects of language for which connections between oral and written forms need to be made there is research evidence for the importance of making clear the connections between oral and written forms for vocabulary, syntax, discourse and phonemic awareness (Dickinson et al., 2006).

There has been much research into the practice of reading aloud to children (Bus, vanIJzendoorn & Pellegrini, 1995; Scarborough & Dobrich, 1994) in which children are able to hear written language structures and forms and view both the text that is read and associated pictures. It is not only the reading of the text itself that is important, but also the talk that takes place around the text when it focuses children’s attention on the content of the written text, engages them in ideas and scaffolds their creation of meaning (McKeown & Beck, 2006). Such ‘substantive conversation’, as it is described in the Productive Pedagogies Theoretical Framework (Education Queensland, 2002), involves ‘sustained conversational dialogue between students, and between teacher and students to create or negotiate understanding of subject matter’ (p. 4).

There is some evidence that this type of sustained high-level conversation may be absent in many early years classrooms, particularly those that contain children from lower socio-economic backgrounds, who may also not be exposed to this type of discourse in their out of school contexts (Teale, Paciga & Hoffmann, 2007; Neuman, 2006).

In the frequency analysis the practice of Oral-Written Language was observed in 134 of the 190 coded episodes and was observed at least once in the classrooms of all teachers.

The number of episodes in which it was observed for individual teachers ranged from a maximum of 10 to a minimum of 1. The mean score for the more effective teachers was 9.57, for the effective teachers the mean score was 6.29 and for the less effective teachers the mean score was 4.6 out of a possible total of 10.

It can be seen in Figure 17 that the six highest locations on the Oral-Written Language item map are occupied by more effective teachers and they are widely dispersed from 1 to 5 logits. Most of the effective teachers are located between 1 and -0.5 logits and three of the less effective teachers are located at the bottom of the map at -3 logits. Two less effective teachers, two effective teachers and one more effective teacher are located near the bottom of the map in locations -1 to -2.5.

**Oral-written language : location 5**

Elizabeth, a more effective teacher, makes many explicit connections between oral and written language in the following example that is located at the highest point of the item map. She has been working with the children on an integrated theme around Australian animals. She has read them stories and played games about Australian animals, she has set up the classroom environment so that it contains images and information to support the children’s learning about the theme and the children have been scaffolded to use the computer as a research tool to find information. Prior to this lesson and over several writing sessions, the children have begun writing their own narratives about Australian animals. As the lesson begins Elizabeth is sitting at the easel, with the
children gathered around her on the floor. She has written the sentence ‘Good authors make great pictures in your head’ at the top of a large sheet of paper that she places on the easel for the children to see.

T: Can you just quickly remind me again what good authors do? Just see if you can read that in your head and we’re going to make a list underneath of what good authors do. Just read that in your head. Is there someone who could read that for us? Daniel?

S: ‘Good authors make great pictures in your head.’

T: ‘Good authors make great pictures in your head.’ When I’m reading a book, sometimes when I’m tucked up in bed at night and I’m reading a book I really love it because even though my book doesn’t have pictures in the book I have lots of //

S: //You imagine them.

T: I imagine them, you’re right and I’ve got fantastic pictures in my head.

S: It’s called your imagination.

T: It is. What did you say Brittany?

S: It’s like a movie in your head.

T: Yes, so…

S: But if it’s getting boring and then the picture’s boring in your head, but if it starts to get exciting it makes the movie a bit more better.

T: Yes makes it more interesting, you’re right. Now can we make a list of those things that you said that good authors do? Oh, I need to use some bullets. I wonder what I should use for bullets.

S: Speech bubbles.

T: ‘Speech bubbles for bullets?’ OK, because we might be saying, ‘What it is that good authors do?’ That’s a good idea. Yes?

S: Books.

T: Oh what a good idea, we could use books for bullets. OK, [draws a book] I hope that’s OK. I need to use some bullets. I wonder what I should use for bullets.

S: Books.

T: They have good describing words.

S: They have good describing words.

T: They use really good describing words. Can you stretch out words for me while I write it?

E: /w/-/er/-/rd/-/sl/.

T: Did you say E-R Renee for the /er/ sound? You’re very clever because that is one way to make the /er/ sound. Good girl. Have a look in the word words; what two letters are standing together to make /er/?

S: O R.

T: O R. Is that true, can O R really make an /er/
Sound? S: Yes you don’t say /w/-erds you say words.
T: I think it might be the /er/ sound; stretch it out.
E: /w/-/er/-/d/-/s/.
T: Fantastic. [Points to the vowel sounds on the THRASS chart.] Yes look E R can make an /er/ sound but so can O R. Oh look.
S: Some people say […] it like that but they say it different to get all the right letters.
T: Oh do they?
S: Yes.
T: OK. All right. Good authors use great describing words; what else do good authors do? I’ll put my next bullet. OK. I wonder if you can help us Fay. Be thinking. I might ask you next. Brittany?
S: Talking.
T: Oh yes, they get their characters to talk. You can put some talking in to your writing; that makes it very interesting. Fantastic. Another bullet. I love that idea of using books for bullets. OK.

It can be seen that Elizabeth is creating high level talk around text as she reviews with the children the elements of a narrative, focussing on the characteristics of good authors with the intention of scaffolding the children’s own story writing. She has begun by clearly outlining the task, ‘We’re going to make a list underneath of what good authors do,’ and then engaging the children in a guided discussion of the topic.

The opening oral discussion about what good authors do becomes concentrated for a while on the importance of good writing as ‘painting pictures in your head’. Elizabeth then refocusses the children on the task of making a list, this time in terms of the format required by the text type and the use of bullets for signalling the items. She makes highly specific connections between spoken and written text as she records the children’s ideas on paper, beginning with the bullet point and followed by the sentence ‘Good authors use great describing words.’ As she begins to write this sentence she asks the children to make connections between spoken sounds and written letters, ‘Can you stretch out the words for me while I write it?’

This leads into a guided discussion of the relationship between the phoneme /er/ and its graphemic representation in the word word, ‘Did you say E R Renee for the /er/ sound? You’re very clever because that is one way to make the /er/ sound.’ It can be seen that throughout this discussion the concepts of phonemes (oral language) and graphemes (written language) are clearly distinguished. The discussion is resolved as Elizabeth demonstrates the use of a known spelling strategy by referring the children to the THRASS chart where they can see alternative spelling patterns for the phoneme /er/. Once the correct spelling is established and demonstrated Elizabeth returns the children’s attention to creating the items for her to write on the list.

It can be seen that in this example Elizabeth has engaged the children in making connections between oral and written language at very high levels. These connections have included talk around features of exemplary written narratives, in demonstrations and/or discussions of relationships between phonemes and graphemes and in the recasting of children’s spoken syntactic forms into the appropriate written form for a list. ‘Good authors…..’ Throughout Elizabeth has engaged the children through her enthusiasm that has created a conspiracy of learning as she has prompted and questioned the children about things she pretends to be unsure of; ‘Can you just quickly remind me again…?’ ‘Is that true…?’ The children have actively listened and responded as she has praised creative thought, ‘I love that idea for using books for bullets;’ ‘Fantastic. They use really good describing words;’ thus reinforcing their high levels of talk around text.

**Oral-written language : locations 1-3.5**

Like Elizabeth, the more effective teachers located between 1 and 3.5 logits on the item map made very clear connections between oral and written language. In their coded examples they addressed a number of connections between the two forms, showing a clear purpose for their instruction that helped to make connections logical and meaningful. The examples from these more effective teachers showed oral to written language connections that were linked to a larger unit of work, theme or inquiry and they had high expectation of children’s involvement in the lesson. Connections between the oral and the written elements of the task were explicitly taught, with appropriate scaffolding and specific, sometimes corrective, feedback.

In the following extract from Vicki’s classroom, the children are asked to relate information in the text being read aloud to them to information gained from previously read texts. This activity requires high levels of thinking, which the teacher encourages through targeted questioning. As she probes and persistently reinforces concepts and content specific vocabulary previously learnt, she extends the children’s content knowledge and through the discussion helps them relate knowledge gained from different texts.

T: [reading from text] *Insects feed in two ways.* Some insects bite and chew their food. *Ants*
and caterpillars feed this way. But we know that some other insects… What do they use to eat? What’s it called Matthew?

S: The jaw.
T: Not the jaw.
S: The proboscis.
T: The proboscis, good boy Brendon. What does a proboscis look like? What’s another good name for it Courtney? It’s like a…?
S: The butterfly’s mouth.
T: It is the butterfly’s mouth, what is Jessica?
S: A straw.
T: It’s like a drinking straw. So… Some insects suck their food up through a hollow tube called a…
E: ‘Proboscis’.
T: That’s right. And butterflies, mosquitoes and flies feed in this way.

The following extract shows Gill working with children to transpose knowledge from the oral to written form. She had initially intended to write a sentence about healthy food, but when a Pre-primary child volunteers to do this she scaffolds his efforts. T: /h/-/e/-/l/-/th/-/y/ [looks at child’s writing on the whiteboard]. How are we going to write the /ee/ phoneme?
S: Like that? [pointing to the letter E on the wall]
T: No. [looks around the group of children] Who have we got here today?
S: I know.
T: You know. What do you think Zac?
S: Y.
T: We do, we use a Y! Well done, we use a Y. [guides child’s hand as he writes] I’ll hold your hand because it has to come like that. So we have now written ‘healthy’.

Here the teacher very carefully segments the word into phonemes as the child writes and, as he does so, asks another child for the correct graphemic representation of the final phoneme /ee/. She then guides the child’s hand so that he is supported in forming the letter and she draws the children’s attention to the correctly written word. In this way she ensures that the children are exposed to a correct written model. She also ensures that appropriate metalanguage is used as she relates letters to phonemes.

In the next extract from Vicki’s classroom the children are participating in a daily calendar activity, where one child leads the reading of the day chart. Participation from all children is encouraged as the teacher ensures that they make links from written to spoken words. This activity builds on the children’s phonological development and their understanding of words as single units of speech. The use of a pointer to guide oral reading shows these Pre-primary children very clear correspondences between written and spoken words as the leader has fun with the teacher, having the power to make the class read fast or slowly.

T: OK, point to each word.
E: ‘Today is Thursday’ [reading as child moves pointer along the words].
T: They’re not allowed to read without you pointing.
[child points to the word the]
E: ‘The’.
T: [aside to children] It’s fun isn’t it?
[child points to 31st]
E: ‘31st’.
T: Isn’t that fun because they can’t go on.
[child points to of August]
E: ‘Of August 2007’.
T: Shall we make them go fast now? [child moves pointer quickly along the sentence ‘The weather is rainy’].
E: ‘The weather is rainy’.

Oral-written language: lower locations

Examples located at 0.5 and lower showed lower levels of engagement by the teacher and tasks with lower levels of purpose and challenge. Although the children appeared to understand the purpose of activities, the focus was usually on task completion rather than on the explicit teaching of the relationships between oral and written language or on creating substantive conversation around text.

One less effective teacher who had read aloud a big book, followed by a cursory discussion of it by the children, then gave the following brief instructions for the making of a story map: ‘Now you’re going to have to think, you have to have your thinking caps on because you need to draw a picture of every part of the story.’ Another read aloud the instructions for a photocopied work sheet with no explanation of the purpose of the task: ‘It says, trace along the dotted line then you’re going to colour the balloon with the B inside the balloon.’

Teachers’ questions focussed on literal understanding, rather than on extension of thought. Connection to a sequence of learning was limited, making it difficult for the children to make connections with prior knowledge about relationships between oral and written language.
Summary

All teachers made some connections for their children between oral and written language. In terms of quantity, the Oral-Written Language practice was observed in almost all episodes of the more effective teachers, around two thirds of the episodes of the effective teachers and almost half of the episodes of the less effective teachers. There were great differences in the quality of the connections made between the language modes, with a range on the item map from -3 to 5 logits. The item map also showed very clear differences between the more effective teachers as a group and the other two teacher groups, in that the six highest locations on the item map (from 1-5 logits) were occupied by more effective teachers (and one effective teacher), most of the other teachers were grouped below them and three of the less effective teachers were clustered at the very bottom of the map.

The highly located more effective teachers made very clear and substantive connections for children between oral and written language. These teachers read to their children from a variety of texts and provided opportunities for extended conversations about written text and its conventions, thereby creating or extending interconnections between language systems. To this end they discussed with children and clarified subject specific vocabulary and concepts encountered in written text and they initiated conversations with their class about substantive features of written text in which meaning was negotiated as children’s contributions were accepted and built upon. They made very clear connections between spoken and written language in terms of grapheme-phoneme correspondences and they modelled particular syntactic structures in both spoken and written forms.

These frequently challenging connections between language modes were made for children in an atmosphere of mutual respect and pleasure in learning and as part of a larger learning sequence or theme that allowed for connections to be integrated into other cognitive and behavioural systems.

Metalanguage

The teacher provides children with language for talking about and exemplifying literacy concepts

The teaching and learning of literacy involves children thinking about language in new ways. It necessitates reflection on the form of both spoken and written language, that is, it makes the elements of language ‘opaque’ and brings them into conscious awareness (Olson, 1994; Watson, 2001). Olson (1994) has used the term ‘metalanguage’ to refer to speech or writing that focuses on any aspect of language. Much of the research into metalanguage in young children has concerned the ways in which they become metalinguistically aware and how these are related to reading acquisition (see for example, Tunmer, Herriman & Nesdale, 1988; Bowey, 2005). The aspect of metalinguistic awareness that has received the most attention has been phonological awareness as it has been clearly shown to be causally related to later reading achievement (see Burgess, 2006, for a review). The development of awareness of syntax, pragmatics and semantics have all received some attention (Tunmer, Pratt & Herriman, 1984) but their relationship to later reading and writing is less clear.

Once children begin school it is expected that there will be explicit reflection on the form of language, that it will become more teacher managed and will have some explicit focus on code breaking (Morrison, Connor & Bachman, 2006). The Productive Pedagogies Framework (Education Queensland, 2002) identifies metalanguage as important in effective classrooms. Classrooms demonstrating high-metalanguage instruction are defined as having an emphasis on discussion about talk and written language, about how written and spoken texts work, about specific technical vocabulary, and about how sentences work. What seems to be particularly important in the early years of school, when children are learning important concepts about written language, is that teachers provide children with specific technical linguistic vocabulary and use this terminology consistently in discussion about spoken and written language.

The literacy teaching practice of Metalanguage was observed in 133 of the 190 coded episodes. It was observed at least once in the classrooms of all teachers. The number of episodes in which it was observed for individual teachers ranged from a maximum of 10 to a minimum of 1. The mean score for the more effective teachers was 9.71, for the effective teachers was 6.86 and for the less effective teachers the mean score was 3.4 out of a possible total of 10.

Figure 18 shows the majority of less effective teachers clustered at the lowest end of the item map. Four of the more effective teachers form a group at the highest location, well separated from the other teachers, with another more effective teacher in the next highest location. The rest of the teachers, that is all the effective teachers, two of the more effective teachers and two of the less effective teachers are located in between, within a relatively small range.

Metalanguage: locations 1.5- 3.5

Examples from the five more effective teachers at these locations showed metalanguage being used to make the purpose of lessons clear. These teachers used metalinguistic
terms to make links between previously taught concepts and new understandings, to provide immediate and focused feedback and to scaffold learning, in addition to developing children’s technical vocabularies. The resources used and concepts taught were appropriate for the children and appeared to be helping the development of understanding of specific metalinguistic terms and related concepts. In the examples at this location, teachers’ use of metalinguistic vocabulary, that assumed children’s understanding of a variety of terms without the need to explain them, suggests that the terms were familiar and a regular part of ongoing classroom discourse. For the most part children’s responses indicated understanding of the metalinguistic terms and the concepts they signified, and were able to use them appropriately in explaining literacy concepts.

In the following example it can be seen that the children are able to use the term digraph to demonstrate an understanding that two letters together make one sound, and the term phoneme to show the understanding that it is a small unit of sound. Gill provides a scaffolded discussion about specific word-level relationships between spoken and written text, using appropriate related technical vocabulary. As she is working with the class to write the ‘sentence of the day’ on the board and begins to write, one of the children claims to be able to do it, so Gill responds by allowing him to write the word healthy and his peer to write food. The child writing begins to segment the word to record it on the board, saying ‘/h/ /h/ softly to himself. Next he carefully writes the lower case letter e. As he does so, two other children in the group relate the sounds to letters or spelling patterns and discuss the possible next letters in the word.

It is clear that Gill has already introduced the metalinguistic term digraph as one of the children volunteers this word, although it is not clear if he understands its meaning. Gill explains that a digraph is needed to spell healthy and that the letter A is needed after the E in order to form the digraph. She then uses the term phoneme in reference to the /e/ sound in healthy that is now written on the board, before asking the children what comes next in the word. After the children suggest I and the child has written it, Gill tells them that they need the sound /th/ next, asks them how they might write it, and uses the term digraph again, in reference to the T and the H. After working quietly with the child at the board helping him to write this, she asks the other children how to write the /ee/ phoneme at the end of the word, and responds enthusiastically when one child suggests the letter Y. Gill uses a similarly scaffolded and supportive process to help the next child write food. Throughout this extract, Gill gives immediate corrective feedback to ensure the focus is on spacing, correct spelling and correct use of lower and upper case letters, all of these being highly specific and appropriate terminology.

T: [standing at the whiteboard] So here, we’re starting on the left and we’re going to the right and I’m going to write healthy. What am I going to use? Oh you know how to do it? Oh

![Figure 18. Item map showing locations for teachers’ examples of Metalanguage](image)
OK, you do it then.

S: \(/h/ /h/\) [child stands at the board and writes lower-case H and E]

S: There’s a digraph.

S: And an L.

S: No, but it’s a digraph

T: An L makes a digraph does it? We do need a digraph but it’s not with an L, it’s with an A [teacher writes lower-case A next to child’s writing of he] and let’s make this a capital because it’s the beginning [teacher changes lower-case H to capital H]. Right, OK, we’ve got the /e/ phoneme, what do we need next? /h/ /e/ /l/

S: L

T: Then we need /th/, how are we going to write /th/?

S: Oh yeah

T: It’s another digraph, it’s another digraph with a T and an H.

S: Ti and Hi!

S: A little Ti? [child writing on the board]

T: [addressing child writing on the board] A little T, like this one [points to ‘t’ in another word on the board] and now a little H. Not like you did at the beginning. [child hears incorrectly and writes capital H; teacher changes it to lower-case] No, that’s a capital; let’s make that small. OK? We don’t have capital letters in the middle of words.

T: [addressing whole class] /h/ /e/ /l/ /th/ /ee/. How are we going to write the /ee/ phoneme?

S: Index.

T: Good girl, it’s the index and I was going to tell you… Where would I find the index Angus?

S: At the very back.

T: At the very back. And what does the index tell us Jason?

S: What difference it is.

T: Sort of, you’re on the right track. Olivia what does it tell us?

S: It tells you, it tells you where the two numbers are.

T: Well it can tell you all the pages of what…? Matthew?

S: What, what they do.

T: It could tell me what they do, yes?

S: About the book.

T: Not so much about the book but about the…?

S: Bugs.

T: About the bugs. So if I wanted to look up butterflies when we were doing butterflies last week I would have looked on page six, page eight, page ten and page twenty-two.

In the following extract from another example at this level Vicki models and guides a text-level discussion on how to access information through the use of an index page. She makes this purpose clear and provides feedback and scaffolding that draws attention to the similarities between the features of a contents page, with which the children are already familiar, and the relatively new concept of an index page. She explains the use of the index page for locating information in a non-fiction text. Throughout this discussion, Vicki’s accurate use of metalanguage provides children with language for talking about these text features.
or theme. These teachers carefully questioned children to elicit information and then used the information to extend and challenge children’s thinking. In this way, the children’s understanding of metalinguistic concepts and terms was developed and extended. In the extract below, that takes place in the library and has been preceded by a discussion of the types of literacy resources available in a library, Vicki initiates an extended discussion within the theme of research about the human body that begins with a focus on the metalinguistic terms title and spine. She challenges the children to identify similar features on a DVD and a book cover and to analyse the purpose of having the title on the spine (to read the title when the book or DVD is on a library shelf). They are able to do this using specific metalinguistic vocabulary appropriately. Even in this brief extract it can be seen that the children are familiar with a variety of other metalinguistic terms such as book, DVD, words, title.

T: [holding up a DVD case] So this is a DVD about…?  
Ss: The body.  
T: [holding up a book] And this is a book about…?  
Ss: The human body.  
T: They both have something that’s similar. What do they have? Kiara?  
S: [...].  
T: They both have spines. On the spine they both have something. What do they have Isabella?  
S: Words.  
T: Yes they both have words on the spine. Very clever. Who can tell me what the words are? James?  
S: The title.  
T: The title, very clever. Why would they do that? Why would the person who published this book or made this DVD, why would they do that? Brooke?  
S: It’s because if it doesn’t have the um title on the spine that means you have to pull the book out to see the title.

The active discussion continues after this extract with a focus on the classification system used in the library, the location of resources and different purposes of texts (factual to inform, tell us real things, the truth and fiction to entertain us) and cartoons as forms of characters.

Teachers at this location carefully scaffolded the children to focus them on content, form and the appropriate use of specific metalinguistic terms. They provided many opportunities to consolidate children’s understanding and use of metalanguage as they persistently reinforced specific terms as part of their literacy teaching. In the following example Megan is scaffolding one child as he reads aloud to the class a sentence that she has written on the easel in order to teach the strategy of reading to the end of the sentence if an unknown word is not readily decodable. She recasts one child’s contribution of dot into the technical terminology of full stop and points out that the next step in the strategy is to decide if the sentence makes sense, a step that she repeats several times to ensure that it is understood. Here Megan is using known metalinguistic terms to help children consolidate a partly learned strategy.

T: This word is too hard to sound out so what’s another thing that he could do? Taleah?  
S: Go to the next word.  
T: Go right to the…, not just the next word. Where do we go? Read to the where?  
S: Read to the dot.  
T: Read on to the full stop. Read on to the full stop and then you think about what would make sense don’t you? What would make sense. What would make sense.  

These more effective teachers taught and used a wide variety of technical vocabulary that addressed a wide range of metalinguistic concepts, showing that they took a broad approach to the content and form of literacy teaching. In their examples the five more effective teachers at this level addressed a wide range of literacy concepts and provided the children with the associated technical vocabulary with which to discuss and process the concepts. Evidence of this can be seen in the range of metalinguistic terms used in these examples that included:

type of book, information book, reading, listening, contents, content, published books, library, borrow, front cover, DVD, title, encyclopaedia, book spine, words, spaces, left, right, write, digraph, capital, beginning, phoneme, little ‘t’, page, pages, picture clues, index, numbers, information, published, numbers, spine label, fiction, purposes, question, true, entertain, inform, characters, cartoons, story, middle of words, words, sentence, double ‘O’; sentences, capital, full stop, author, describing words, talking, characters, list, bullets, book, pictures, movie, reading, imagine, make sense, read on, sound out, read out loud.

**Metalanguage: locations 0-0.5**

In three of the four examples at these locations there was an emphasis on word level concepts. Related metalinguistic
vocabulary was used appropriately to provide children with
texture and repetition of specific concepts.

T: You’re getting very good at hearing the end
of words and when you’re writing you’re using
the beginning sounds and you’re using the
end sounds. Now I’ve also got some pictures
and we’re going to listen for the end sound.

Many of these examples showed teachers using questions as
a means of focussing the children on specific metalinguistic
terms and their meaning. In doing so, these teachers used
precise and appropriate language.

T: It’s got a capital letter B at the beginning and
it’s got a full stop at the end so do you think
it might be a sentence? I think it is. If it’s got a
capital letter at the beginning and a full stop
at the end is it a sentence?

The teachers provided some scaffolding of the form and use of
some metalinguistic terms, or of strategies the children could
use in their reading and writing.

T: [looking at a big book with the children] Now
could we have a look at this word here? I can’t
sleep, can’t. Can you tell me something about
that word? Carol can you remember?
S: It’s a shortened word.
T: It is a shortened word and it’s got a special
name hasn’t it? Can you remember what we
called shortened words Jessica?
S: It means that we’ve taken a word out of it
T: It means we’ve taken a letter out of it so if
we put the letter back in what would it say?
Instead of can’t it would say… Blake?
S: Can not.
T: I can not. Good boy. I can not sleep. And that’s
got a special name. Can you remember what
the special name is starting with a /c/ Mimi?
S: Contraction.
T: Good girl, contraction, we call it a contraction. Good
girl.

The metalinguistic terms used by these teachers reflected
the aspects of literacy that were taught and practised. It can
be seen in the following list that shows many of the terms
used by these teachers that there was an emphasis on word
level aspects with one teacher attending to the structure of
narrative text:

question mark, full stop, capital, sentence, lower case, beginning,
whole sentence, end, shortened word, letter, word, contraction,
starting with, end sound, end of word, hearing, writing, beginning
sounds, pictures, story, narrative structure, title, orientation,
characters, setting, beginning, ending, start, problem.

Metalanguage: lower locations

Most of the teachers at lower locations usually used
metalinguistic terms that were appropriate, but gave little
explanation of their meaning and did not build on the
children’s understanding. There was generally a focus on the
activity in which the terms were used, rather than on the terms
themselves.

T: Remember with your writing … don’t make all
your letters capitals. Remember they’re
lower-case.

Within these activities, some support for particular literacy
concepts using appropriate terminology was sometimes
provided to individual children, although there was little or no
extension of learning.

T: And what do you need at the end of a
sentence?
S: Fullstop.

However, at the very lowest locations teachers’ use of the
terms letter and sound was sometimes confused, making it
difficult for children in the early stages of reading and writing
to gain a stable understanding of these basic concepts that
are essential components of reading and writing. Where more
complex concepts such as question and statement were
discussed explanations were unclear or confused. Teachers’
use of metalanguage did not appear to be part of a planned
teaching sequence. Feedback provided was minimal, and
did not build on children’s knowledge and did not correct
misunderstandings.

The technical terms related to spoken or written language
that were used by the teachers in these lower locations were
for the most part amongst those commonly used by teachers
in higher locations and mostly referred to basic concepts. It
was clear from these teachers’ examples that they quite often
used non-technical terms that did not precisely describe the
concept or skill being addressed. It was also clear that when
technical terms were used they were either not explained or
inadequately explained, and it was often unclear whether the
children understood them. The concepts represented by the
following terms, and used in these teachers’ examples, were
often superficially addressed:

<title, author, illustrator, blurb, understand, picture, number, list,
characters, newspaper, re-reading, ideas, picture, page, book,
library, means, story, front (of the book), sound, letters, capitals,
lower case, words, full stop, write, writing, written, read, sentence,
mistake, joining word, exclamation mark, sentences, dot, dash,
questions, statement, answer.
Summary

In the frequency analysis, the practice of Metalanguage, in which the teacher provides children with the language for talking about and exemplifying literacy concepts, was observed in almost all the episodes of the more effective teachers. It was observed in just over two thirds of the effective teachers’ episodes, and just under two fifths of the episodes of the less effective teachers. In terms of the quality of this practice, there were clear differences between these groups of teachers in that nearly all of the more effective teachers were clustered at or near top of the item map and the majority of the less effective teachers were clustered near the bottom.

The more effective teachers, who were clustered at the top of the item map, consistently used a wide variety of technical literacy-related vocabulary in highly appropriate ways. This technical vocabulary represented the expertise of these teachers in exposing the children to a broad view of literacy that included extended and deep discussion about word level features including phonological awareness and phonics, sentence forms, comprehension of text, use of texts and some critical analysis of text. Appropriate use of this technical vocabulary enabled children to consciously reflect on the form of language as well as on its content and interpretation. Further, the more effective teachers’ high level technical use of metalanguage was accompanied by other high-level classroom practices that consistently supported the children’s learning.

3.5 Effective Teaching of Early Years Literacy

In view of the highly controlled methodology of pair-wise analysis and the strong relationships shown between teacher effectiveness in terms of the literacy growth of their students, and observation of teachers’ classroom practice in terms of the Classroom Observation Schedule – Revised (CLOS-R), it is possible to draw some conclusions about the teaching practices of the sample of effective teachers of early years literacy.

The more effective teachers of Pre-primary and Year 1 children took a broad approach to the teaching of literacy that did not rely on any one aspect. They took a highly structured systematic approach to the explicit teaching of word-level knowledge and skills that included phonological awareness, phonics and spelling. These teachers identified a sequence of what needed to be taught, taught it explicitly, persistently reinforced what was being learnt and provided many opportunities for guided and independent practice. They also provided the children with the specific metalinguistic terminology with which to refer to this knowledge and they ensured that they and the children used such terminology consistently. Their careful articulation of focus words and parts of words helped children attend to the concepts being taught, as did their embedding of these foci within the context of games, quizzes and other highly motivating activities that included songs and dances. Another feature of these teachers was that they often embedded their teaching of word level concepts and skills within a broad theme of work so that children were able to see a purpose and use skills and knowledge in meaningful ways.

Also embedded within a broader context were these teachers’ explanations of sentence level concepts that were, however, much less frequent than explanations of word level concepts. Whilst the more effective teachers were clearly differentiated from the effective and less effective teachers in terms of frequency and quality of word level explanations, these differences were less clear for sentence level explanations. There was some talk, mostly in oral language interactions, about using complete sentences and punctuating them in written language but, with one notable exception, there was little explicit talk about the content of sentences in addition to their form. Nevertheless, particular sentence forms clearly modelled by teachers and the implicit requirement in particular activities to express content within a specific sentence structure were features of the more effective teachers’ classrooms.

The more effective teachers had a clear emphasis on text features. They introduced children to a range of texts and created high levels of thoughtful discussion around them. By the middle of the school year when the video observations were made it was evident that the children in their classes were familiar with a range of text types that included fiction and non-fiction within a range of print, video and interactive media. When using non-fiction texts children were learning strategies for finding the information they needed, to consult a number of texts, and to question the authenticity of texts. When fiction was used they were required to make comparisons between the intentions of different authors and illustrators and to focus on the elements of narrative in order to guide their own story writing. Children were challenged to make use of the resources of text user, text participant and text analyst.
The more effective teachers all had a good command of spoken language and created many opportunities for developing and extending the oral language of the children in their classrooms. For children in Pre-primary and Year 1 this is particularly important as instruction and general communication rely on this medium. The more effective teachers were clearly differentiated in both quantitative and qualitative analyses from the effective and less effective teachers in the ways in which they encouraged children’s use of oral language. These teachers introduced their children to a variety of discourses and situations in which oral language skills were developed and extended. Tasks included dramatising stories, thoughtful and extended discussion around texts and high-level oral language games. It was clear that these teachers were highly engaged in classroom oral language activities as they provided targeted support to children, based on their own sustained active listening to the content and form of children’s responses.

Not only did the more effective teachers have a strong focus on oral language as a medium of instruction and communication, they also demonstrated and encouraged children to make the connections between oral and written language modes. As a group they were clearly differentiated from the effective and less effective teachers, particularly with regard to the quality of the connections made. They made clear and substantive connections for children between oral and written language. These teachers read to their children from a variety of texts and provided opportunities for extended conversations about written text and its conventions, thereby creating or extending interconnections between language systems. To this end they discussed and clarified with children subject specific vocabulary and concepts encountered in written text and they initiated extended conversations with their class about substantive features of written text in which meaning was negotiated as children’s contributions were accepted and built upon. They made very clear connections between spoken and written language in terms of grapheme-phoneme correspondences and they modelled particular syntactic structures in both spoken and written forms.

In making these connections between language modes the more effective teachers consistently used a wide variety of technical literacy-related vocabulary. This technical vocabulary represented the expertise of these teachers in exposing the children to a broad view of literacy that included extended and deep discussion about word level features including phonological awareness and phonics, sentence form, comprehension of text, use of texts and some critical analysis of text.

This broad view of literacy was presented by the more effective teachers to children in classrooms that were characterised by consistency in the use of all CLOS-R teaching practices. Children attended to literacy tasks and there was mutual respect between teacher and children in terms of rapport, credibility of the teacher and citizenship, including equality and recognition of the needs of others, practices that were demonstrated to some extent by all teachers. Children were motivated to take part in literacy tasks and there was a clear sense of their purpose, practices demonstrated to some degree by many teachers. The more effective teachers had high levels of awareness of children’s participation and their literacy teaching was structured, it had strong forward momentum and addressed substantial aspects of literacy, practices demonstrated consistently by some teachers.

The more effective teachers’ classrooms were also characterised by a number of teaching practices that few of the other teachers demonstrated with any degree of consistency. These teachers provided high levels of support in their literacy lessons, with many opportunities for practice of taught concepts and skills, as they made use of all available opportunities for literacy teaching and practice and made clear connections between known and new concepts and skills. They provided high quality corrective feedback, made systematic use of the literacy environment and challenged children to engage in high levels of thinking. They differentiated literacy instruction for individual needs, based on formal or informal assessment of children, encouraged independent learning and were flexible in responding to children’s literacy contributions.

What was particularly noticeable in the observation of the teachers’ classrooms was the dynamic and complex mix of all the CLOS –R teaching practices. These teachers seamlessly moved between word, sentence and text level according to their knowledge of the children, the literacy concepts and the skills that needed to be taught.
Numeracy
4. NUMERACY PHASE 1: DEVELOPMENT OF THE CLASSROOM OBSERVATION INSTRUMENT

4.1 INTRODUCTION

The Trends in International Mathematics and Science Study (TIMSS) data (NCES, 2003 and 1999 TIMSS Video Study (Hiebert et al., 2003) drew attention to a need to improve the quality of teaching in lower secondary mathematics classes in Australia (Hollingsworth, Lokan, & McCrae, 2003) and in other participating countries (Desimone, Smith, Baker, & Ueno, 2005; MacNab, 2000). As part of the Numeracy Research and Development Initiative (2001-2004), the Australian Government provided over $7 million to fund 4 National projects and 10 States and Territories projects to investigate teaching and learning strategies associated with effective teaching; that is, teaching that leads to improved numeracy outcomes for students. To empirically substantiate improvements in teaching quality or investigate effective teaching in mathematics classrooms, robust measures of teaching quality and teaching effectiveness must be available.

The rhetoric espoused in standards documents that promote excellence in mathematics teaching often equates the idea of teaching quality with teaching effectiveness in terms of easily quantifiable, proxy variables representing the quality of teaching actions specifed on the schedule can be reliably observed and estimated to represent a measure of teaching effectiveness. For these reasons, details of how to code, record and score the ToMOS are provided for teachers or researchers wanting to use the ToMOS as a tool for mathematics teachers (both inservice and preservice) who are looking to improve their effectiveness. For these reasons, details of how to code, record and score the ToMOS are provided for teachers or researchers wanting to use the instrument. In addition to the development of a valuable instrument for investigating the quality of mathematics teaching, the results revealed considerable variance in achievement gains estimated for similar classes taught by the same teacher. The implications for research and educational decision making based on multilevel analyses of student learning gains in secondary school settings are discussed in light of these findings.

4.2 BACKGROUND

While teachers are not the only influence on student achievement, they make a significant contribution to it. In a meta-analysis of over 500,000 studies that examined factors that impact on student achievement, Hattie (1992, 2003) estimated that teacher factors accounted for about 30% of
variance in student achievement. This compared with student factors (such as prior cognitive ability and disposition to learn) that were estimated to account for around 50% of variance, school factors (such as class size and leadership effectiveness) that accounted for about 5-10%, home factors (such as levels of parental expectations and encouragement) that accounted for about 5-10%, and peer factors (such as bullying and peer tutoring) that accounted for 5-10% of variance.

Contemporary value added models, such as the Covariate Adjustment Model (CAM) and the Annual Gains Model (AGM), are often used to partition variance in student achievement gains into different levels (e.g., the student level, teacher or classroom level, and the school level). Attempts to quantify the effect teachers make based on the amount of variance to be explained at the teacher or classroom level, have produced different estimates depending on the model of analysis used (Rowan, Correnti, & Miller, 2002). Nevertheless, a substantial proportion of variation in student achievement gains is thought to lie within schools rather than between schools (Konstantopoulos, 2006), and in the early years at least, teacher effects appear to be larger for mathematics achievement than reading achievement (Nye, Konstantopoulos & Hedges, 2004).

An early body of research examining teacher traits and characteristics of teaching episodes associated with achievement gains was reviewed by Brophy and Good (1986). In this review, a distinction was made between pre-sage variables used to operationalize teacher traits, including enthusiasm and years of experience, and process variables used to operationalize characteristics of teaching episodes, including time spent on whole class teaching. These variables were among those considered most influential in explaining achievement gains at this time. It could be argued that this body of research needs updating if it is to be relevant and inform current practice, given the shift in focus from teacher centred learning to student centred learning, and greater recognition of constructivist learning principles. Less contentious is the argument that this research needs to be substantiated and extended based on the improved statistical models now available to estimate student achievement gains and investigate teacher effects.

More recently, there has been renewed interest in the mathematics education literature to develop improved measures of pre-sage and process variables in an attempt to explain teaching effectiveness. For example, Hill, Rowan and Lowenberg Ball (2005) developed a measure of teachers’ pedagogical knowledge for teaching mathematics (a pre-sage variable) and found it to explain a significant amount of variance in student achievement gains. A number of process variables capturing mathematics teachers’ use of reform teaching strategies have also been developed and found to explain student achievement gains (Schoen, Cebulla, Finn, & Fi, 2003; Saxe & Gearheart, 1999; McCaffrey, Hamilton, Stecher, Klein et al., 2001). However, the number of contemporary studies of this nature published in scholarly journals is not in proportion to the current emphasis placed on very specific criteria promoted in standards for mathematics teaching. Furthermore, a closer look at the measures representing instructional practices aligned with current educational reforms reveals that they are largely based on teacher self-reports and to a lesser extent, on expert ratings of observed practice where the observation criteria are not made explicit. This is worth noting for two reasons: from a research perspective, there is often a disparity between what mathematics teachers report they do and what they actually do in the classroom (Mayer, 1999); from an educational perspective, findings from observations based on expert ratings may not be easily adapted to preservice and in-service education programs, particularly if the rating criteria are not made transparent.

Given the current emphasis and proliferation of teaching standards in mathematics, including Standards for Excellence in Teaching Mathematics in Australian Schools (Australian Association of Mathematics Teachers [AAMT], 2006), and Principles and Standards for School Mathematics (National Council of Teachers of Mathematics [NCTM], 2000), it is somewhat surprising to find a dearth of contemporary studies that have substantiated the effectiveness of actions commonly associated with quality teaching by showing that these actions explain exceptional achievement gains made by students. Such studies are critical if theories of effective teaching are to be empirically substantiated. Research developments of this nature are hindered by a lack of suitable instruments for measuring teaching quality.

The aim of this research project was to develop an observation schedule that could be used in situ to identify specific teaching actions that are commonly associated with effective teaching. The report is presented in three phases: (a) developing the ToMOS based on a review of the literature and preliminary testing, (b) measuring teaching effectiveness based on an estimate of Year 8 student achievement gains, and (c) pilot testing the ToMOS by examining the relationship between teaching quality and teaching effectiveness.
4.3 Phase 1: Developing the Teaching of Mathematics Observation Schedule

As the chosen method of data collection in this project was observation, it was thought that public time would be the most appropriate time in the lesson to observe teaching actions. Public time refers to segments in a lesson when the teacher and students are involved in public (rather than private) interaction. Public time was defined to take the following forms:

- The teacher providing an explanation, demonstration, or instruction to the class;
- A class discussion where teacher and students participate; or
- Students’ sharing ideas, solution methods, and processes with the class.

Public time was operationalised as being a segment of time lasting at least one minute long. Thus to qualify for a shift between public and private time, the episode of time must last for at least one minute.

The objective of Phase 1 of the research project was to construct items for the observational schedule based on a review of relevant literature. Findings from the review were categorised into themes, actions associated with each theme were identified and items were written. Preliminary testing of each item was then carried out and certain items were eliminated or refined.

Reviewing the literature

The literature reviewed encompassed 10 recent large-scale, government funded studies in mathematics education, which are summarised in Table 19. The studies were chosen based on the criteria that they incorporated an investigation of where effective teaching was likely to be taking place (based on an analysis of achievement gains or the extent to which learning outcomes were enhanced) together with some examination of teacher characteristics and/or teaching practices. Three of the studies reviewed involved inquiry in lower secondary mathematics classes in Australia:

- Investigation of effective mathematics teaching and learning in Australian secondary schools (Ingvarson, Beavis, Bishop, Peck, Elsworth, & Australian Council for Educational Research, 2004);
- Middle years numeracy research Project 5-9 (Siomon, Virgona, & Cornaille, 2001); and
- School innovation: Pathway to the knowledge society (Cutance & Innovation and Best Practice Consortium [IBPC], 2001).

The fourth was an international study that targeted teaching in Year 8 classes in seven countries including Australia:

- Third international mathematics and science study (TIMSS) 1999 video study (Hiebert et al., 2003; Hollingsworth, Lokan, & McCrae, 2003).

Four of the large-scale studies were part of the Australian Government Numeracy Research and Development Initiative 2001-2004 and were directed at primary education (K-7):

- Building mathematical understanding in the classroom: a constructivist teaching approach (Catholic Education South Australia [CE SA], 2004);
- Researching numeracy teaching approaches in primary schools (Victorian Department of Education and Training [Victorian DET], Catholic Education Commission of Victoria, & Association of Independent Schools of Victoria, 2004);
- Teachers enhancing numeracy (Department of Education, Science and Training [DEST], Education Queensland [Ed Qld], Queensland Catholic Education Commission, & Association of Independent Schools of Queensland, 2004); and
- What’s ‘making the difference?’ Achieving outstanding numeracy outcomes in New South Wales primary schools (DEST), New South Wales Department of Education (NSW DET), Catholic Education Commission New South Wales, & Association of Independent Schools of New South Wales, 2004).

The other two large-scale studies focused on primary education and were based in the UK:

- Effective teachers of numeracy (Askew, Brown, Rhodes, Johnson, William, 1997) and
- the Leverhulme study (Brown, 2000; Brown et al, 2003).
<table>
<thead>
<tr>
<th>Countries</th>
<th>Schools</th>
<th>Principals</th>
<th>Mathematics coordinators</th>
<th>Teachers or classes</th>
<th>Students</th>
<th>Year level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingvarson et al</td>
<td>1</td>
<td>43</td>
<td>16</td>
<td>34</td>
<td>182</td>
<td>4348</td>
</tr>
<tr>
<td>Siemon et al</td>
<td>1</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>81</td>
<td>2899</td>
</tr>
<tr>
<td>Cuttance &amp; IBPC</td>
<td>1</td>
<td>14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hiebert et al</td>
<td>7</td>
<td>638</td>
<td>-</td>
<td>-</td>
<td>638</td>
<td>-</td>
</tr>
<tr>
<td>CE SA</td>
<td>1</td>
<td>9</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>269</td>
</tr>
<tr>
<td>Victorian DET et al</td>
<td>1</td>
<td>32</td>
<td>-</td>
<td>-</td>
<td>&gt;180</td>
<td>&gt;600</td>
</tr>
<tr>
<td>DEST, Ed Qld et al</td>
<td>1</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>37</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>DEST, NSW DET et al</td>
<td>1</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>&gt;4700</td>
<td>-</td>
</tr>
<tr>
<td>Askew et al</td>
<td>1</td>
<td>11</td>
<td>6</td>
<td>-</td>
<td>90</td>
<td>-</td>
</tr>
<tr>
<td>Brown et al</td>
<td>1</td>
<td>40</td>
<td>≈ 40</td>
<td>≈ 40</td>
<td>≈ 40</td>
<td>≈ 3400</td>
</tr>
</tbody>
</table>

In the studies reviewed, methods for examining teacher characteristics and/or teaching practices included classroom observation, analysis of work samples, and surveys and interviews of school principals, mathematics coordinators, teachers, and students. While a number of studies incorporated measures of student satisfaction and teacher characteristics (including mathematical content knowledge, mathematical pedagogical knowledge, mathematics beliefs and attitudes, and professional development experiences) only one study (DEST, Ed Qld et al., 2004) adopted a measure to represent the quality of classroom based teaching practices.

To develop items for the ToMOS, the literature was reviewed to highlight teaching practices that have been associated with effective teaching and could potentially be observed during public time. The findings were organised into eight themes (presented in no particular order): Choice of task, Student thinking, Consolidation, Feedback, Systematic development of content, Making connections, Direct teaching and Language.

**Choice of task**

Effective mathematics teachers were reported to use different types of tasks. These included “games, authentic (real-life) problems, and extended investigations” (Siemon et al., 2004, p. 82) and the use of real world or real life applications (e.g., Askew et al., 1997; CE SA, 2004; DEST, Ed Qld et al., 2004; DEST, NSW DET et al., 2004; Victorian DET et al., 2004). They also included tasks that involve the use of concrete materials or manipulatives (Siemon et al., 2001; Victorian DET et al., 2004; DEST, Ed Qld et al., 2004) - particularly in the early years (CE SA, 2004; DEST, NSW DET et al., 2004). The use of authentic problems was not supported by findings from the TIMMS Video Study (Hiebert et al., 2003), where the percentage of problems with a real-life connection was found to be low in higher performing countries and tended to be higher in lower performing countries.

Tasks that students find relevant, interesting, and enjoyable were reported to have a positive influence on numeracy outcomes (DEST, Ed Qld et al., 2004). Fun activities involving discussion and drill-and-practice at the beginning of lessons were characteristic of some effective classrooms (DEST, NSW DET et al., 2004); however, Brown (2000) reported that teachers in schools with consistently high gains in student achievement exhibit “a shared commitment to focussing on children’s mathematical learning rather than on provision of pleasant classroom experiences” (p. 5).

Siemon et al. (2004) commented on the regular use of open-ended tasks and questions by effective middle-school teachers. The link between the use of open questions and tasks, and teacher effectiveness is echoed in four of the large-scale studies in primary settings (CE SA, 2004; DEST, NSW DET et al., 2004; DEST, Ed Qld et al., 2004; Victorian DET et al., 2004). The definition of open questions/tasks varied in the reports, but a key characteristic was that they invite more than one answer (DEST, Ed Qld et al., 2004).

The use of open-ended questions and tasks are regarded as being effective practice as they can admit student discussion on a variety of levels (DEST, Ed Qld et al., 2004) and be a means for exploring the extent of students’ understanding (Victorian DET et al., 2004). They can help learners “establish,
consolidate, extend, reinforce and reflect on concepts, skills and applications” (DEST, NSW DET et al., 2004, p. 161). Open-endedness can also be constituted through asking students to use different solution strategies (DEST, Ed Qld et al., 2004). For example, The TIMSS Video Study highlighted the teaching strategy of analysing multiple student solutions to a single problem used in Japan (a higher achieving country). This approach has since attracted much international interest (Groves et al., 2004).

Based on a review of literature relating to the theme Choice of Task, a teacher action labelled Multiple Solution Strategies was included in the ToMOS.

**Student thinking**

Teachers who draw out and build upon student thinking were identified in the literature as being effective. CE SA (2004) reported that learning outcomes improved when teachers (a) established students’ mathematical thinking using questioning techniques then (b) continued this interactive process to support students in building mathematical understanding. DEST, NSW DET et al. (2004) concluded that an important strategy for maintaining focus on learning was building on students’ knowledge and experiences. One of Askew et al.’s (1997) major findings was that highly effective teachers use pupils’ methods and reasoning as starting points for engaging with numeracy concepts, establishing mental strategies for calculating, making mathematical connections, and addressing misconceptions. Siemon et al. (2004) concluded that “teaching approaches which value and build on each student’s contribution … are more likely to lead to improved numeracy outcomes” (p. 106).

Student thinking can be drawn out using purposeful discussion in whole class or small groups settings or with individual pupils (Askew et al., n.d.), or by using particular activities in small group settings that encourage the exploration of ideas (DEST, NSW DET et al., 2004). An effective scaffolding practice for building upon student’s understanding was identified (called apprenticing), where the “teacher provides opportunities for more learned peers to operate in a student-as-teacher capacity” (Victorian DET et al., 2004, p. 3).

Based on a review of literature relating to the theme Student Thinking, a teacher action labelled Respect was included in the ToMOS. This is described as the action whereby the teacher responds to a student initiated comment or question in an elaborated way.

**Consolidation**

A number of reports identified that effective teaching involved activities or actions that helped students to consolidate what they had learned. Siemon et al. (2004) observed that effective middle-school teachers encouraged students to reflect on what they had learned using class discussions and reviews, or by using reflective tools such as learning journals. Victorian DET et al. (2004) found that one of 12 scaffolding practices that led to improved learning outcomes was where the “teacher orchestrates a recount of what was learnt … typically … during whole class share time at the end of a lesson” (p. 3). DEST NSW DET et al. (2004) concluded that effective lessons included “a closure that consolidated the concepts and thinking underlying activities through questioning and discussion” (p. 57-58). The TIMMS Video Study (Hiebert et al., 2003) found that in higher performing countries, more summary statements were made about the lessons.

Based on a review of literature relating to Consolidation, a teacher action labelled Summary was included in the ToMOS.

**Feedback**

Feedback is mentioned explicitly in 8 of the 10 large scale studies. One of the major outcomes reported by Siemon et al. (2001) was that numeracy outcomes improved significantly in schools when staff made a commitment to include review and feedback in each teaching session. In primary settings, classroom enquiry that included feedback was thought to enhance numeracy outcomes (DEST, Ed Qld et al., 2004) and quality teachers were identified as those who (among other things) monitored individual student learning and provided individualised feedback (DEST, NSW DET et al., 2004). In addition, CE SA (2004) commented on the importance of teachers’ feedback, including written feedback, in students’ workbooks, immediate feedback when teachers converse with students one-to-one and in small groups, continuous feedback provided through a range of ongoing assessment strategies, and feedback that either affirmed or challenged students’ thinking. On the use of feedback, Askew et al. (1997) found that highly effective teachers used students’ errors as a means of engaging with them in order to further their understanding.

Based on a review of literature relating to the theme Feedback, a teacher action labelled Misconceptions was included in the ToMOS.

**Systematic development of content**

Several studies reported the systematic use by teachers, of curriculum documents showing growth points, achievement indicators, syllabus outcomes, or other logical developments of mathematics content. For example, DEST, NSW DET et al. (2004) reported that key strategies which contributed to outstanding numeracy outcomes were
Identifying specific outcomes as the lesson focus, linking indicators to outcomes, structuring explicit teaching steps to achieve outcomes within a lesson structure that is predictable, with an introduction, activity focus and conclusion. (p. 46)

DEST, Ed Qld et al (2004) concluded that planning by teachers and schools was one of six elements of learning environments that influenced students’ numeracy outcomes most. In particular, teachers’ ability to plan well-connected lessons and a logical, sequential flow of lessons from the general to the specific” (p. 57), and that such planning included “breaking down instruction into steps that often reflect levels or stages of understanding” (p. 57). Another approach to systematic development of content is reported in the TIMMS video study (Hollingsworth et al., 2003) as it relates to problem-solving. Teachers from higher achieving countries tended to use mathematically related problems that “tie the content of the lesson together” and are sequenced to “provide good opportunities for students to construct mathematical relationships” (p. 67).

Based on a review of literature relating to the theme Systematic Development of Content, a teacher action labelled Intentions was included in the ToMOS.

**Making connections**

Making connections is a theme in seven of the large scale studies reviewed here. Askew et al. (n.d.) described how highly effective teachers connect “different areas of mathematics and different ideas in the same area of mathematics using a variety of words, symbols and diagrams” (p. 2). DEST, Ed Qld et al. (2004) referred to students’ being able to make connections between different representations of a concept, connecting real-world enactments, concrete models, language, icons and symbols, and unusual and prototypic examples. Teachers in the study by CE SA (2004) were supported by a document listing connections students might make in relation to particular concepts. Siemon et al. (2001) noted how effective teaching allows students to make “connections between prior knowledge and new learning, ‘school mathematics’ and ‘real world’ applications, and problem-solving strategies” (p. 82).

Siemon et al. elaborated that:

> while many students will be able to learn from the experience of doing, this depends on having access to a network of related ideas which inform and are shaped by the doing. Without the linking, connecting ideas and the means to access and elaborate those ideas, the doing becomes a boring, repetitive and unproductive exercise. (p. 55)

In the TIMMS Video Study (Hiebert et al., 2003), mathematical processes that were used to solve problems publicly in class were coded as either giving results, using procedures only, stating concepts (with no discussion about mathematical reasoning), and making connections (where explicit references were made to mathematical relationships). The percentage of problem solutions where connections were made and concepts were stated were relatively high, in higher achieving countries.

Based on a review of literature relating to the theme Making Connections, teacher actions labelled Emphasises Meaning and Multiple Representations were included in the ToMOS.

**Direct teaching**

The theme of direct teaching was distinguished in six of the large scale studies. Siemon et al. (2001) commented that “from the students’ point of view the most important contribution teachers can make is to communicate mathematical ideas and texts effectively to them, on a one-to-one basis where needed” (p. 59). Cuttance and IBPC (2001) concluded that one of the most effective practices in developing student capacity in mathematics is “the use of clear explanations” (p. xvi).

In primary settings, CE SA (2004) observed that effective teachers gave explicit instruction to individual students when they were working on investigations. DEST, NSW DET et al. (2004) concluded that that one important factor in maintaining the focus on learning tasks was “explicit teaching of concepts” (p. 57). Two of the 12 practices that Victorian DET et al. (2004) linked with high gains in student achievement have elements of direct teaching. The first is orienting, where the “teacher sets the scene, poses a problem, establishes a context, invokes relevant prior knowledge and experience, provides a rationale” (p. 3). The second is modelling, where the “teacher shows students what to do and/or how to do it … [and] instructs, explains, demonstrates, tells, offers behaviour for imitation” (p. 3). By way of contrast to the above findings, others (e.g., DEST, Ed Qld, 2004) point out that interactive student-centred teaching rather than direct teaching enhances numeracy outcomes. Siemon et al. (2001) made the point that a mixture of teacher-directed and student-centred approaches is most effective.

Based on a review of literature relating to the theme Direct Teaching, the teacher action labelled Quality was included in
the ToMOS, an action whereby the teacher explicitly states the criteria for quality work. The previously referred to action included in the ToMOS labelled Intentions was also related to this theme. Another action labelled Responsibility was also included to represent the balance between teacher centred and student centred learning. This is described as the action whereby the teacher explicitly encourages students to take responsibility for their own learning.

Language

Mathematical language is considered explicitly in six of the large scale studies. Siemon et al. (2001) reported that successful middle years’ numeracy schools “attend to literacy aspects of mathematical texts and representations, for example, the meaning of terms, written expressions, how to read diagrams, tables, graphs, symbolic texts” (p. 82). Askew et al. (1997) identified that focusing on the development of mathematical language is one aspect of developing students’ reasoning. Victorian DET et al. (2004) highlighted the necessity of making language explicit. DEST, Ed Qld et al. (2004) referred to the importance of teachers’ extending students’ mathematics terminology, which allowed them to discuss important mathematical ideas. They also observed that teachers’ inconsistent use of terms caused difficulties in communication. CE SA (2004) described the effective practice of brainstorming, where the teaching purpose was that students would link their own language with conventional mathematical language. Word lists were created and put on display and new words were added over time.

DEST, NSW DET et al. (2004) concluded that focusing on language was one of three main factors that explained improved numeracy outcomes. Strategies included organising the classes so students could talk, having students work on tasks in pairs or groups or with a parent or teacher, having students explain strategies, justify conclusions, and ask questions of each other, orally or in written language; emphasising the role of language in mathematics learning, and encouraging LBOTE students to discuss problems in their home languages.

Based on a review of literature relating to the theme Language, the teacher action labelled Mathematical Language was included in the ToMOS.

Other

The review revealed other notable factors including that effective teachers of mathematics provided a challenging curriculum, identified and accommodated difference including students’ different capacities and special needs, and used a range of assessment and monitoring practices to guide planning. Personal attributes of teachers, such as enthusiasm for maths and infectious enjoyment for teaching, were also linked with effectiveness. These factors are not detailed in this review due the difficulty of measuring them using an in situ observation schedule during public time.

4.4 Item Selection, Recording and Scoring the ToMOS

The aim of developing an observation schedule that could be completed in situ influenced the decision to restrict the ToMOS to ten teaching actions, however initially many items were considered. For each theme identified in the review findings, different items were written, describing associated teacher actions. Care was taken to describe actions that were equally likely to occur during a maths lesson, regardless of the content being taught. Preliminary testing of each item was then carried out.

Preliminary testing involved two ToMOS developers observing four teachers teach one mathematics class each, at a school that was equipped with an observation room attached to a classroom. The observation room contained a one-way viewing window and was sound proofed. This set up allowed the developers to discuss any differences in the teacher actions each identified and to construct criteria for a coding manual to minimize or resolve these differences, without interrupting the class.

Certain items were eliminated because of a difficulty achieving inter-rater agreement during preliminary testing and based on adherence to the goal of keeping the teacher actions objectively observable (as far as possible) without assuming expertise on behalf of the observers. Eventually ten well functioning items were chosen to be represented in the ToMOS. These were categorized into two broad dimensions: Communicates Expectations and Focuses on Conceptual Understanding. A description of each action is presented in Table 20. A coding manual was developed to help identify each of the ten actions. The coding manual was further refined in Phase 3 and is presented in Appendix 5.
While the teacher actions identified in the ToMOS are thought to be indicative of effective teaching (an assumption requiring empirical support), the ToMOS is designed to measure quality teaching. It is not assumed that quality will be related to the number of times each action is observed in a lesson. Rather it is proposed that quality is related to a teacher’s repertoire of these teaching actions. The scoring of the ToMOS is based on this proposition. The ToMOS is designed to be used in two, non-consecutive classrooms and it is scored out of ten: each action can be scored 1 if it is observed at least once during the two lessons or it is scored 0 if it is not observed.

An in situ data collection record sheet (see Appendix 5) was designed for recording the observed teaching actions during episodes identified as public time. The record sheet consists of a table with columns representing five minute blocks of the lesson and rows corresponding to each of the ten teacher actions. The record sheet also includes space to code on-task student behaviour during each episode of public time. For an episode of public time to be coded not on task, at least 25% of students have to be observably not on-task at any point in the episode. Any observations made during a public time episode where students are not on task, are not to be considered for scoring purposes.

To pilot test the ToMOS it was necessary to compare a teacher’s ToMOS score with a measure of teaching effectiveness, based on recorded achievement gains made by their students. National testing in Australia provides achievement data in numeracy/mathematics for students in Years 3, 5, 7 and 9. The two year period between testing means that little can be inferred about the individual contribution a teacher makes to student learning based on differences in student performance over a single year. The procedure used in this project for estimating achievement gains over one year was particularly complex and is presented here as a separate phase.

5. PHASE 2: ESTIMATING YEAR 8 STUDENT ACHIEVEMENT GAINS

The objective of Phase 2 of this research project was to undertake a value added analysis of student achievement gains in mathematics to obtain a measure of teaching effectiveness for participating Year 8 teachers. A reduced sample of teachers was then invited to be involved in pilot testing the newly developed instrument (Phase 3).

5.1 METHODOLOGY

Participants and settings

Prior to the research being conducted, approval was obtained from two university ethics committees (Edith Cowan University and The University of Western Australia) and from the Department of Education and Training, Western Australia.

A convenient random sample of DET District and Senior High schools across Western Australia was contacted and selected based on a positive response from the head of mathematics departments to an information flyer detailing the research project. The 24 participating schools included 17 metropolitan schools and 7 country schools in Western Australia. Twenty one schools had an SEI (Socio Economic Index) measure within one standard deviation (10) of the mean (100) for the State, two

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**TABLE 20**

**Teaching actions in the ToMOS**

<table>
<thead>
<tr>
<th>Dimension 1: communicate expectations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentions</td>
<td>The teacher states the mathematics learning intended in the lesson.</td>
</tr>
<tr>
<td>Quality</td>
<td>The teacher states criteria for quality work.</td>
</tr>
<tr>
<td>Responsibility</td>
<td>The teacher encourages responsibility for mathematics learning.</td>
</tr>
<tr>
<td>Respect</td>
<td>The teacher responds with respect to mathematical questions and comments initiated by students.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension 2: focuses on conceptual understanding</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphasises meaning</td>
<td>The teacher helps students interpret the meaning of solutions.</td>
</tr>
<tr>
<td>Multiple solution methods</td>
<td>The teacher draws focus to more than one solution method.</td>
</tr>
<tr>
<td>Summary</td>
<td>The teacher makes links to generalised cases.</td>
</tr>
<tr>
<td>Misconception</td>
<td>The teacher addresses common misconceptions.</td>
</tr>
<tr>
<td>Multiple representations</td>
<td>The teacher uses alternative ways to represent mathematical ideas.</td>
</tr>
<tr>
<td>Mathematical language</td>
<td>The teacher clarifies key mathematical language.</td>
</tr>
</tbody>
</table>
schools had an SEI measure of 86.0 and 89.14, and one school had a measure of 118.65. The heads of mathematics departments from each school provided survey information indicating school details, department priorities for Year 8 mathematics, the number and length of lessons provided for Year 8 mathematics learning and whether or not Year 8 students were streamed. Four department heads did not return this survey information. Of the 20 schools with information, 9 were Middle Schools, 10 were Senior High Schools and 1 was a District High School. Seventeen department heads indicated that outcomes-based assessment was a priority for the recording of student achievement levels and five department heads indicated that outcomes-based assessment as a philosophy or approach to teaching was a priority. On average, schools timetabled 240 minutes per week for mathematics but allocations ranged across schools from 180 to 480 minutes per week. The Year 8 mathematics teachers in the participating schools were provided with an overview of the objective to examine effective teaching, invited to participate, and informed that all data would be confidential, and that they could withdraw from the study at any time without prejudice. In total 95 teachers agreed to participate and provided written consent indicating this. Participating teachers were asked to provide survey data on their qualifications and experience; 85 teachers (49.2% female) completed the survey (giving a response rate of 89.5%). Table 21 presents a summary of the survey data for teacher participants.

| Number of years teaching maths | 12.8 (11.1) |
| Number of years teaching at school | 4.8 (5.6) |
| High School (Year 11 to 12) | 17.4 |
| Undergraduate | 43.2 |
| Postgraduate | 12.1 |

Note. Includes 27.3% missing data.

The number of teacher participants from the same school ranged from 1 teacher to 11 teachers. The variation in the number of Year 8 mathematics classes taught by the same teacher and participating in the research included one class (70 teachers), two classes (18 teachers), three classes (4 teachers), four classes (2 teacher) and six classes (1 teacher). Thus 132 classes of students participated in the research plus ten classes. Teacher survey information also indicated the number of students in the class who were Aboriginal or Torres Strait Islander (ATSI) and the number of students with a language background other than English (LBOTE); 53% of classes included one or more ATSI student and 73.5% included one or more student with LBOTE.

Information outlining the research was then distributed to students and parents in the participating classes and parental written consent for student participation was sought. Consent was obtained for 2,864 students (47% female).

**Numeracy assessments**

A numeracy achievement score for each student was collected towards the end of Year 8 and matched with their achievement score obtained for the numeracy part of the Year 7 Western Australian Literacy and Numeracy Assessment (WALNA). The WALNA is a curriculum based assessment that is criterion referenced and administered to all children in Years 3, 5 and 7 in Western Australian primary schools, as part of the State Government’s program to monitor standards in education. As well as knowledge and skills in numeracy, reading, spelling and writing are assessed towards the end of the year. Assessment results are calibrated on a common logit scale based on a Rasch measurement model to ensure a scaled measure of achievement and to allow comparisons to be made over time. The scale of measurement is referred to as the WAMSE scale and WAMSE scores (or WAMSES) range from 0 to 800.

The numeracy component of the WALNA administered in Year 7 assesses outcomes associated with Space, Measurement, Chance and Data, Number and Pre-algebra. A small number of questions also require students to demonstrate outcomes associated with Working Mathematically. It requires approximately 45 minutes for students to complete and includes multiple choice questions, questions requiring short answers and open-ended questions. The Year 8 numeracy assessment designed specifically for this research consisted of items drawn from a bank of WALNA items yet to be used at the state wide level and was comparable with the Year 7 WALNA in terms of length and composition. Given the level of confidentiality appropriate for benchmark testing, details of the Year 8 numeracy assessment administered for this research are not given. An example of each type of question is, however, provided in Table 22. Responses for the Year 8 numeracy assessment were also calibrated onto the WAMSE scale.
**Table 22**

An example of each type of question on the Year 8 numeracy assessment

<table>
<thead>
<tr>
<th>Multiple-choice type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A newspaper report stated: “The population of Australia in nineteen million and fifty-three thousand” According to this report, the population of Australia, in figures, is:</td>
</tr>
<tr>
<td>A 1 958 000</td>
</tr>
<tr>
<td>B 19 053 000</td>
</tr>
<tr>
<td>C 190 053 000</td>
</tr>
<tr>
<td>D 19 000 053 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short-response type</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is (6 + 3)?</td>
</tr>
<tr>
<td>= $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open-response type</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the one difference between a square and a rectangle?</td>
</tr>
</tbody>
</table>

**Procedure**

Year 8 students in the participating schools sat the assessments from October 17 to November 5, 2005, during their scheduled mathematics class. The time set aside for the assessments was 45 minutes. This comprised 10 minutes for instructions, distribution and collection of materials, and 35 minutes to complete the assessment. Fourteen invigilators undertook the testing across the school sites. Invigilators were supplied with detailed administration guides based on the Monitoring Standards in Education administration guide. Teachers were asked to stay in the class during the assessment and invited to complete student surveys for each participating class member while the students completed the assessments. All assessments were removed from the school at the completion of the lessons.

Each classroom teacher was sent a Mathematics Results Sheet through the Head of Department showing box and whisker plots representing the distribution of numeracy achievement scores for their class and the study sample in Years 7 and 8, as well as individual scores for each student.

**Data analysis: statistical models to estimate achievement gains**

A two-level variance components model was fitted to the Year 8 numeracy assessment data to estimate student achievement gains. Year 8 numeracy scores were adjusted for students’ prior achievement (based on Year 7 numeracy scores) and ASTI status, and the variance in adjusted scores were decomposed into classroom and student components. The adjusted score at the classroom level, referred to in the results section as the class residual score, represents gains made in students’ numeracy achievement for each class. The class residual score was used as a measure of teaching effectiveness.

**Model A: Unconditional (without any predictors) model**

The unconditional model enables partitioning of the variance of Year 8 numeracy scores into the between-student, within-class component \((\sigma_j^2)\) and the between-class component \((\tau_j^2)\). The equations for the unconditional model are as follows:

\[
\gamma_{ij} = \beta_j + \epsilon_{ij}, \quad \epsilon_{ij} \sim N(0, \sigma^2)
\]

\[
\beta_j = \gamma_{00} + \alpha_j, \quad \alpha_j \sim N(0, \sigma^2)
\]

\[
 ICC = \frac{\sigma^2}{\sigma^2 + \sigma_j^2}
\]

\(Y_{ij}\) is the WAMSE Numeracy score in Year 8 of student \(i\) of class \(j\). This score is expressed as the sum of the class \(j\)’s mean \((\beta_j)\) and the deviation \((\epsilon_{ij})\) of student \(i\)’s score from the class mean. The mean of class \(j\) is in turn expressed as the sum of the grand mean \((\gamma_{00})\) and the deviation \((\alpha_j)\) of class \(j\)’s mean from the grand mean.
Model B: Conditional on Year 7 numeracy (WAMSE) scores

$$\gamma_{ij} = \beta_{0j} + \beta_{7j} \gamma_{ij} + r_{ij}, \ r_{ij} \sim N(0, \sigma^2)$$

$$\beta_{0j} = \gamma_{00} + u_{0j}, \ u_{0j} \sim N(0, \tau^2)$$

$$\beta_{7j} = \gamma_{70}$$

$$\text{ICC adjusted for } \gamma_{70} = \frac{\tau^2}{\tau^2 + \sigma^2}$$

As the objective of this exercise is to study 'value-added' residuals during the year, effects of student prior performance in Year 7 and individual variables that may affect the performance in Year 8 should be factored out of the residual. Year 7 performance, however, was the main predictor of Year 8 performance. This factor would include the effects of many student background variables that were not measured in the study. In Model B, only the prior performance in Year 7 is included as a predictor at the student-level model. With the introduction of the Year 7 scores as a predictor, the regression intercept $\beta_{0j}$ is the class mean after adjusting for prior performance of the student in Year 7. The conditional ICC with this adjustment can be calculated using the residual variance.

Model C: Conditional on Year 7 scores and other significant individual variables

$$\gamma_{ij} = \beta_{0j} + \beta_{7j} \gamma_{ij} + \beta_{ATSIj} ATSI_{ij} + r_{ij}, \ r_{ij} \sim N(0, \sigma^2)$$

$$\beta_{0j} = \gamma_{00} + u_{0j}, \ u_{0j} \sim N(0, \tau^2)$$

$$\beta_{ATSIj} = \gamma_{ATSI0} \beta_{ATSIj} = \gamma_{ATSI0}$$

ATSI status of the student was found to be a significant predictor of Year 8 performance after adjusting for Year 7 scores. ATSI status was added as a predictor in the final student-level model. The resulting regression intercept $\beta_{0j}$ is the mean for class $j$ after adjusting for prior performance in Year 7 and the ATSI status of the students. This adjusted mean can be used as a measure of teaching effectiveness.

5.2 RESULTS

Numeracy achievement scores were collected for 2,864 Year 8 students, nested within 132 classrooms and 24 schools, towards the end of the school year. These scores were then matched with each student’s corresponding Year 7 numeracy score. Matching scores were not available for 316 students and these scores were coded as missing data. Based on a valid sample size of 2,548 students, descriptive statistics for numeracy achievement scores are given in Table 23.

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Year 7</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 7</td>
<td>366</td>
<td>412</td>
<td>462</td>
<td>517</td>
<td>561</td>
<td></td>
</tr>
<tr>
<td>Year 8</td>
<td>385</td>
<td>429</td>
<td>491</td>
<td>540</td>
<td>598</td>
<td></td>
</tr>
</tbody>
</table>

The median score increased by around 30 WAMSES for the study cohort; this represents a measure of expected achievement gain (learning). Students in the 10th percentile, however, achieved a gain of around 20 WAMSES and those in the 90th percentile achieved a gain of 37 WAMSES; this represents a widening of the achievement gap between low performing and high performing students during Year 8.

A two-level variance components model was fitted to the Year 8 numeracy achievement scores. The unconditional model (Model A) indicated that the proportion of variance in numeracy achievement was partitioned into 68.1% of variance at the student level and 31.9% at the class/teacher level. The conditional model (Model B) incorporated Year 7 numeracy scores as a predictor of Year 8 numeracy scores and accounted for 57.7% of variance in numeracy scores. Model C incorporated Year 7 numeracy scores and ATSI status as a predictor of Year 8 numeracy scores and accounted for 58.2% of variance attributed to possible student effects on achievement gain.

Model C was chosen over Model B. See Table 24 for a summary of results.

An achievement gain ‘value-added’ analysis of residuals was then undertaken by adjusting Year 8 numeracy scores for prior achievement and ATSI status to produce adjusted mean-point estimates of residuals for each class. Residuals are displayed in Figure 19.
TABLE 24

Results from the two-level variance components model fitted to explain Year 8 WAMSE numeracy scores

<table>
<thead>
<tr>
<th>Model A: unconditional (without any predictors) model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Within (student level) variance</td>
<td>4511.02097</td>
</tr>
<tr>
<td>Between (class / teacher level) variance</td>
<td>2114.33414</td>
</tr>
<tr>
<td>Total variance</td>
<td>6625.35511</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model B: conditional on prior performance (Year 7 scores)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Within (student level) residual variance</td>
<td>2516.70552</td>
</tr>
<tr>
<td>Between (class / teacher level) variance</td>
<td>283.67424</td>
</tr>
<tr>
<td>Total unexplained variance</td>
<td>2800.37976</td>
</tr>
<tr>
<td>Explained variance</td>
<td>3824.97535</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model C: conditional on Year 7 scores and ATSI status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Within (student level) residual variance</td>
<td>2502.18643</td>
</tr>
<tr>
<td>Between (class / teacher level) variance</td>
<td>269.99167</td>
</tr>
<tr>
<td>Total unexplained variance</td>
<td>2772.1781</td>
</tr>
<tr>
<td>Explained variance</td>
<td>3853.17701</td>
</tr>
</tbody>
</table>

Figure 19. The adjusted residual calculated for each Year 8 classroom

Each circle in Figure 19 represents the adjusted residual calculated for each Year 8 classroom. The whiskers indicate 95% confidence intervals. The y axis represents residual scores measured in WAMSES. A residual of 0 indicates that the mean achievement gain for the class was exactly that expected based on the performance of the study sample. A residual of 30 indicates that the achievement gain was 30 WASMES about that expected and a residual of -30 indicates that the achievement gain was 30 WASMES below that expected.

Taking a conservative approach to identifying highly effective classes, an examination of classes where the achievement gain adjusted residual and the lower boundary of the uncertainty interval was above that expected, eleven classrooms were highlighted as being highly effective. Taking a similar approach to identify less than effective classrooms, an examination of classrooms where the achievement gain adjusted residual and the upper boundary of the uncertainty interval was below that expected, revealed seven classrooms were less than effective. This left 114 classes, which were identified as being effective (as expected). Descriptive statistics for classrooms identified as being highly effective and less than effective are presented in Tables 25 and 26.
It is interesting to note that none of the 11 highly effective classes initially comprised mostly low achieving students (Table 25). This could indicate that (a) classes of initially low achieving students are more likely to be allocated teachers who are least capable of producing exceptional achievement gains or (b) it is harder to produce exceptional achievement gains in classes comprising mostly low achieving students. Given that only two of the seven classes identified as being less than effective were classes that initially comprised mostly low performing students (Table 26), the second explanation appears most fitting.

An interesting finding resulting from the multilevel analysis was the marked difference found in residuals for classes who were taught by the same teacher. This is best illustrated using the extreme cases where classes were considered to be either highly effective or less than effective. Five of the 11 teachers who taught classes identified as being highly effective, taught at least one other class participating in the study. In Table 27, the residuals calculated for these classes are displayed, along with information pertaining to each teacher. Two of the seven teachers identified as teaching less than effective classes also taught more than one Year 8 class and these residuals are displayed in Table 28.

**Table 25**

<table>
<thead>
<tr>
<th>Class rank</th>
<th>Class residual</th>
<th>SEI</th>
<th>School area</th>
<th>Year 8 streamed</th>
<th>Year 7 class mean</th>
<th>Class size (students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>132</td>
<td>33.37</td>
<td>105.3</td>
<td>Metro</td>
<td>Yes</td>
<td>503.91</td>
<td>25</td>
</tr>
<tr>
<td>131</td>
<td>32.74</td>
<td>100.97</td>
<td>Metro</td>
<td>No</td>
<td>543.92</td>
<td>28</td>
</tr>
<tr>
<td>130</td>
<td>27.31</td>
<td>98.59</td>
<td>Metro</td>
<td>No</td>
<td>517.63</td>
<td>21</td>
</tr>
<tr>
<td>129</td>
<td>26.30</td>
<td>99.23</td>
<td>Metro</td>
<td>No</td>
<td>492.58</td>
<td>21</td>
</tr>
<tr>
<td>128</td>
<td>26.29</td>
<td>109.48</td>
<td>Metro</td>
<td>Yes</td>
<td>506.11</td>
<td>28</td>
</tr>
<tr>
<td>127</td>
<td>23.37</td>
<td>105.3</td>
<td>Metro</td>
<td>Yes</td>
<td>473.50</td>
<td>26</td>
</tr>
<tr>
<td>126</td>
<td>22.79</td>
<td>109.48</td>
<td>Metro</td>
<td>Yes</td>
<td>564.79</td>
<td>26</td>
</tr>
<tr>
<td>124</td>
<td>20.39</td>
<td>107.20</td>
<td>Metro</td>
<td>No</td>
<td>565.78</td>
<td>21</td>
</tr>
<tr>
<td>123</td>
<td>19.66</td>
<td>105.30</td>
<td>Metro</td>
<td>Yes</td>
<td>499.07</td>
<td>28</td>
</tr>
<tr>
<td>122</td>
<td>18.98</td>
<td>100.97</td>
<td>Metro</td>
<td>No</td>
<td>441.20</td>
<td>24</td>
</tr>
<tr>
<td>121</td>
<td>18.27</td>
<td>95.43</td>
<td>Metro</td>
<td>-</td>
<td>541.27</td>
<td>30</td>
</tr>
</tbody>
</table>

Note. The class ranked 125 achieved a achievement gain residual between the classes ranked 124 and 126 but was not identified as being highly effective as the lower boundary of the uncertainty interval was below zero. Uncertainty intervals are influenced by class size, which in this case was 12 students. The Year 7 class grand mean = 457.26.

**Table 26**

<table>
<thead>
<tr>
<th>Class rank</th>
<th>Class residual</th>
<th>SEI</th>
<th>School area</th>
<th>Year 8 streamed</th>
<th>Year 7 class mean</th>
<th>Class size (students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-31.04</td>
<td>98.59</td>
<td>Metro</td>
<td>No</td>
<td>451.95</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>-31.02</td>
<td>96.88</td>
<td>Country</td>
<td>No</td>
<td>400.29</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>-24.42</td>
<td>94.11</td>
<td>Metro</td>
<td>-</td>
<td>411.73</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>-23.27</td>
<td>95.39</td>
<td>Country</td>
<td>No</td>
<td>438.30</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>-21.98</td>
<td>98.59</td>
<td>Metro</td>
<td>No</td>
<td>428.42</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>-20.77</td>
<td>95.59</td>
<td>Country</td>
<td>No</td>
<td>448.83</td>
<td>24</td>
</tr>
<tr>
<td>9</td>
<td>-19.67</td>
<td>104.98</td>
<td>Metro</td>
<td>Yes</td>
<td>452.73</td>
<td>55</td>
</tr>
</tbody>
</table>

Note. The classes ranked 6 and 7 (containing 12 and 15 students respectively) were not identified as being less than effective as the upper boundary of the uncertainty interval was above zero. The Year 7 class grand mean = 457.26.
Di
dfferences in Year 7 achievement levels appear to account
dfferences in residuals across classes taught by the same
teacher. For example, it could be argued that Teacher G
(Table 28) is not as 
effective with initially low achieving Year 8
students but is effective teaching average achieving students;
or that Teachers A, B and E (Table 27) are particularly 
effective with high achieving students. The one exception is Teacher
F, where differences in initial achievement do not appear to
account for dfferent class residuals.

The argument that prior performance accounts for
achievement gains is supported by the finding that class
residuals were significantly correlated with Year 7 class means
($r = 0.483$, $p < 0.000$). This means that around 23% of variance in
achievement gains can be explained by prior performance.

**Table 27**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>No. of years teaching maths</th>
<th>Class rank</th>
<th>Residual</th>
<th>Year 7 class mean</th>
<th>Class size (students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher A</td>
<td>30 years (Degree + DipEd)</td>
<td>130</td>
<td>27.31</td>
<td>517.63</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>71</td>
<td>1.05</td>
<td>444.77</td>
<td>25</td>
</tr>
<tr>
<td>Teacher B</td>
<td>3.5 (Masters)</td>
<td>128</td>
<td>26.29</td>
<td>506.11</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>98</td>
<td>8.77</td>
<td>477.60</td>
<td>24</td>
</tr>
<tr>
<td>Teacher C</td>
<td>24 (Masters)</td>
<td>127</td>
<td>23.37</td>
<td>473.50</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>46</td>
<td>-7.08</td>
<td>432.26</td>
<td>23</td>
</tr>
<tr>
<td>Teacher D</td>
<td>20 (Degree + DipEd)</td>
<td>124</td>
<td>20.39</td>
<td>565.78</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>86</td>
<td>5.94</td>
<td>518.11</td>
<td>20</td>
</tr>
<tr>
<td>Teacher E</td>
<td>17 (Degree + DipEd)</td>
<td>121</td>
<td>18.27</td>
<td>541.27</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>-14.37</td>
<td>431.00</td>
<td>20</td>
</tr>
</tbody>
</table>

Note: The Year 7 class grand mean = 457.26.

**Table 28**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>No. of years teaching maths</th>
<th>Class rank</th>
<th>Residual</th>
<th>Year 7 class mean</th>
<th>Class size (students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher G</td>
<td>7 (no maths qualification)</td>
<td>3</td>
<td>-24.42</td>
<td>411.73</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>-11.52</td>
<td>432.83</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>76</td>
<td>1.41</td>
<td>432.57</td>
<td>20</td>
</tr>
<tr>
<td>Teacher F</td>
<td>1 (Degree + DipEd)</td>
<td>8</td>
<td>-20.77</td>
<td>448.83</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>84</td>
<td>5.47</td>
<td>448.95</td>
<td>24</td>
</tr>
</tbody>
</table>

Note: The Year 7 Class grand mean = 457.26.

Differences in Year 7 achievement levels appear to account
for differences in residuals across classes taught by the same
teacher. For example, it could be argued that Teacher G
(Table 28) is not as effective with initially low achieving Year 8
students but is effective teaching average achieving students;
or that Teachers A, B and E (Table 27) are particularly effective
with high achieving students. The one exception is Teacher
F, where differences in initial achievement do not appear to
account for different class residuals.

This finding highlights possible limitations associated
with using a multilevel analysis and adjusted class residual
(representing student achievement gains) as a measure of
teaching effectiveness. Although this measure is used in the
following pilot test, it is done so with noted caution. The
implications of this finding for future research and practice are
discussed at the end of this section.
6. Phase 3: Pilot Testing the ToMOS

6.1 Method

Participants

Initially all 11 teachers identified in Phase 2 as having taught highly effective classes (or their head of department) were contacted and a random sample of about 20 teachers identified as having taught an effective class were also contacted. No teacher who had taught a class identified as being less than effective was invited to participate in the pilot study.

Overall, nine teachers who participated in Phase 2 of the study agreed to participate in pilot testing the ToMOS. Teacher participation involved allowing the two ToMOS developers to sit and observe them teaching two non-consecutive Year 8 maths classes, and agreeing to have these classes videotaped.

The low participant rate was due in part to movement across schools and across classes (many teachers were no longer teaching lower secondary maths). It was also due in part to teachers’ reluctance to having a class videotaped – highlighting the importance of developing an observation schedule that can be completed in situ for research purposes in a secondary school setting. (Video was only required as the ToMOS was still in a stage of development). Two of the nine teachers indicated a willingness to be involved on the proviso that their class was audiotaped only and this request was granted.

Procedure

Once teachers expressed a willingness to participate, written consent was required from all principals, teachers, students and parents involved. The project manager arranged with the teacher for a research team to visit two, non-consecutive Year 8 maths classes at a time and day convenient to the teacher. (One teacher was observed teaching Year 9 maths classes). The instructions to the teacher were to choose two lessons that were typical lessons. The only information provided to teachers was that the research team was interested in observing and recording what quality teaching looked like. The research team included the two ToMOS developers (who coded observations in situ) as well as a professional camera operator (for consenting teachers).

The two coders sat together at the back or to the side of the classroom and the camera operator found a convenient position in the classroom to stand with a tripod. Individual students who did not have written consent to participate and be video taped, were seated together behind the camera or to the side, and the camera operator was instructed to avoid recording these students. The teacher was fitted with a microphone.

On the record sheet, which is sectioned into five minute segments of time (see Appendix 5), each coder used shading to indicate public time versus public time episodes and recorded each time a teacher action identified in the ToMOS was observed during a public time episode. Each action was recorded only once during a five minute segment of time. If the same action continued over to the next five minute segment, it was still only recorded once. An approximate time when the teacher action occurred was recorded and where possible, notes relating to the teacher action were made to help resolve potential differences.

During public time episodes, each coder recorded their observations separately. During larger episodes of private time, the two coders compared and discussed their records and resolved any differences to the satisfaction of both coders, if they were able to do so without disturbing students’ work. Any differences that could not be quickly resolved were noted. Public time segments of each lesson observed were transcribed and resolved at a later time.

6.2 Results

Eighteen maths lessons were observed: two lessons taught by nine different teachers. In total, teacher actions specified on the ToMOS were observed 95 times and inter-rater agreement was reached during the lesson on 82 of these occasions (86%). The 13 differences were later resolved easily by viewing the video or reading the public time transcriptions and making minor changes to the wording of the coding manual.

The extended description for each ToMOS teacher action found in the final coding manual is presented below, along with one transcribed episode to illustrate the action in a classroom context.

Intentions (INT)

The teacher makes verbal or written statements about the specific mathematics learning intended in the lesson. The learning intentions may relate to:

- ‘Big’ mathematics ideas (for example, key ideas at the strand level),
- Particular mathematics concepts, or
- Tasks and assignments.

The intentions will typically be presented in the form of goal statements prior to engaging in some mathematical work.
Example -
T: Okay we're actually going to look at a particular type of equation today and the type we're going to look at only has one pronumeral in it. [Under the heading Equations, teacher writes on the board eg. 4x – 1 = 23.] You don't need to copy this down yet. That's the type of equation I'm going to look at. Does anyone know why or anything interesting about that one? Anything at all you notice?
S: You could probably work it out.
T: You could probably work it out, she's got it. What does she mean, you could probably work it out? What does work it out mean? Yes?
S: An answer.
T: Yes and what do you mean, an answer?
S: What is x.
T: What is x, thank you. That's what you meant isn't it? Okay do you want to know the correct term for that, working it out, finding an answer? Solve. So we're going to solve equations today [teacher extends the heading on the board by writing – Solve Equations] and the only way we can solve them is if we're only dealing with one pronumeral at a time and we can actually work it out, what is the value of x.

Quality (QUAL)
The teacher communicates in verbal or written form explicit criteria for quality responses to tasks assigned. The teacher may also explicitly distinguish levels of performance. Criteria presented by the teacher may relate to:
- Mathematical accuracy,
- Mathematical ingenuity, or
- Communication/presentation of ideas.
Levels of performance might include:
- Rubric descriptions or
- Numeric/alphabetic grades

Example -
T: Now what I haven't seen on a lot of people's work for the perimeter of the triangle is any working out so this is what we would expect to see. C what were the measurements of your triangle? Okay so what's this one? …
S: 28.
T: 28.
S: 20.
T: 20, and did you measure this side? Okay we're working out the perimeter of this triangle forgetting the rectangle around the outside. It has a face of 28, height of 28 and C mentioned from there to there and he got a distance of?
S: 34.
T: 34 okay, excellent. So how did you work out the perimeter of your triangle then C?
S: Just added them altogether.
T: Added them altogether. So this is what I would have expected to see, 28 add 20 and 34, 20 plus 20 is 40 plus 30 is 70 and we’ve got 8 and 4 so that makes 82cm. [Teacher writes on board P = 20 + 28 + 34 = 82 cm]

Responsibility (RESPO)
The teacher makes statements that encourage student responsibility for learning mathematics. The kinds of student responsibilities that teachers might encourage include:
- Asking questions to seek clarification,
- Asking questions to inquire about, or suggest, new ideas or possibilities;
- Focusing or concentrating on their mathematical work,
- Allocating appropriate time for independent studies associated with their mathematical learning,
- Checking and justifying solutions and solution methods, or
- Self and peer assessment.

Example -
T: You should all have your survey work out in front of you which has been levelled. What I'd like you to do now is just spend one minute looking through your work, so you should have your questionnaire at the front, and then the way in which you tallied your results. Quite possibly then you have your pie graphs, bar graphs, Venn diagrams, if you just keep flipping through, all the different strategies that you used to tally the results. Okay. What I'd like you to do is first of all look through yours. Where did you do a good job? What sort of strategies, just keep it to yourself for now, what sort of strategies, what were your graphs, what did they look like? What were the features that you had to use? Have a look at the questions on your survey, what was the first question, what was the second question? Why did you choose those? What sort of questions did you have, multiple choice, any written answers, tick a box? Which questions were more successful in getting the answers that you were after? Have a look at those for a moment.
Respect (REPT)

The teacher responds with respect to mathematical questions and comments initiated by students. The kinds of teacher responses that indicate respect include:

- Addressing with the class a response to a student's mathematical question or idea
- Redirecting a student's mathematical question or idea to the class, e.g. “What do the rest of you think about that?”

Example -

T: You have a comment.
S: Every time, well it depends what kind of thing because when you get a job you get this taxation slip and it says if you're under eighteen you do not have to pay tax and I did that but they came back to me and said that if you're earning over a hundred bucks you need to pay tax.
T: I don't know that there's a rule about under eighteen to do with tax, there might be.
S: Because on the tax slip there's like three points and it says if you're under eighteen and do not wish to pay tax you don't have to because you need to be earning like over six grand a year or under eighteen.
T: That's true but I don't think whether you're under or over eighteen actually has something to do with it. There is a rule about being under eighteen and getting money other than through working for it, there's a different rule completely about that, possibly that's what was on there. By and large if you earn more money you're going to be paying tax but it doesn't kick in, and you're right about the $6,000, it's around about $6,000 a year when you need start paying tax. [Teacher makes note on the board: About $6000 a year is when tax starts.]

Multiple solution methods (MSOL)

The teacher draws focus to more than one solution method for a worked example. The multiple solution methods will either:

- Be presented by the teacher or
- Be presented by students with acknowledgment by the teacher.

Students have been asked to complete five “drill” questions at the start of the lesson to practice their mental arithmetic skills. The first question is 24x20.

Example -

T: Okay everyone's had a chance to have a go at all of those. Now let's have a look at the first one. Who wants to offer me a way to calculate that mentally? C?
S: 20x20 and 20x4
T: 20x20 and 20x4, so 20x20 in your head was 400 and you had 20x4.
S: 80.
T: 80 so you added those together and you got 480. Who else has got that answer by the way? Excellent. Who can tell me another way to calculate that one?
S: 2x24 and then add the zero.
T: 2x24, 48, add the zero. That's one less step than yours really C.

**Summary (SUMM)**
The teacher provides a summary statement that clearly links a problem to a more generalised case. The summary statement will include information about either:
- A strategy for solving similar examples and/or
- The key features of these general mathematical ideas

**Example** -
T: So if we have another person now, okay now I’m earning $47,000 per year, $47,000 so we’re getting up into a wage that is perhaps reasonably common, that sort of money is earned by a lot of people, if we don’t pay tax on the first 6 and then after that it starts being taxed at 20% until we hit $20,000 then it jumps up to 30% until we hit $35,000 then it jumps up to 40% on anything we earn above $35,000. How are we going in our pay packet now? Again the idea is the same as in the previous one where you look at how much you’re earning in each, they call them brackets, and tax it at the right rate in each bracket. I’ll get someone from the other side to put it up and you can tell them then whether you agree or not.

**Misconceptions (MISC)**
The teacher intentionally addresses common student misconceptions by requiring students to analyse examples, solutions, or ideas. The kinds of questions that might indicate the teacher’s intention to address a misconception include:
- Why wouldn’t this work?
- Why isn’t this correct?
- Could this be correct? Why/why not?

**Example** -
The teacher asks students to copy down a list of numbers: 6, 10, 5, 9, 2, 12, 4, 17, 18, 15, 8, 14, and 7.
T: What’s the median of that list? Find me the middle number. Middle number is?
S: Four.
T: We’ll pretend these are scores out of twenty on a test so not everyone's done terribly well on this particular test. We call the middle number the median but if someone else had written down that list they might not have written down the same order that I did might they? If I was marking them and when I finished as I was marking them I turned them over and so when I finished I turned them back up and wrote everyone's score down in that order, someone else may have mixed them up a bit and by the time they come to write the list out they may well not have been written the same but it's the same class. All the numbers will be the same but they'd be in a different order, so number four isn’t actually the median. It might be sitting in the middle of that list but it’s not the median. Why is it not the median? Do you recall what the rule was about the median?
S: You must put them in order first
T: You must put them in order first so can you rewrite that list in order this time. The median is the middle number but it’s not four, only happens to be four because that’s how I wrote this this particular time. We need to get it back in order.

**Mathematical Language**
The teacher clarifies key mathematical terms and symbols to promote student understanding of mathematical language. Teacher clarification will take the form of either:
- The introduction of new key terms and symbols, or
- The refinement of existing key language through questioning, rephrasing, or additional explanation.

The teacher’s verbal or written description of the key mathematical term or symbol will be followed by either:
- A question to students that probes their understanding of the term or symbol,
- A question to students that requires an application of the term or symbol, or
- An elaborated example of how the term is used in a particular context.

**Example** -
T: The interquartile range, this word sounds a bit like … what do you think this might mean?
S: Quarter.
T: Quarter, yes. It’s sort of drop the bottom quarter off, drop the top quarter off and where’s the middle part, that’s more or less what it’s asking us.

**Multiple representations (MREP)**
The teacher uses alternative ways to represent mathematical ideas. For an episode to be coded Multiple Representations (MREP), the teacher would use two or more of the following at any point in the episode:
- Written symbols, formulae, or descriptive examples;
• Graphs and tables;
• Drawings or diagrams, and
• Physical materials.

Graphs, tables, drawings and diagrams may be part of a problem statement, used in a solution process, or used in a discussion of a mathematical idea or concept. Physical materials may be used to demonstrate a solution process or in a discussion of a mathematical idea or concept. A table is an arrangement of numbers, signs, or words that exhibits a set of facts or relations in a definite, compact, and comprehensive form. Typically the rows and/or columns of a table are labelled and have borders. To count as a drawing or diagram, the drawing must include information relevant to doing the mathematics. It does not count as a drawing if the symbols are spatially arranged to highlight certain features, if arrows are pointing to certain symbols to highlight them, or if arrows or other nonstandard marks are used in place of standard symbols (e.g. an arrow is used instead of an equal sign). Physical materials include:

• Measuring instruments (e.g. Ruler, protractor, compass).
• Special mathematical materials (e.g. Tiles, tangrams, base-ten blocks).
• Geometric solids.
• Cut-out plane figures (e.g. Triangles and trapeziums cut from paper).
• Papers, pencils, calculators and computers are not included here.

The use of measuring instruments for non-measurement purposes, such as underlining or drawing straight lines with a ruler, or drawing a circle of unspecified measure with a compass, does not count. If it is unclear whether or not measuring instruments are being used to measure, assume they are not. Using graph paper to plot points on the coordinate plane does not count, but using graph paper to measure the surface area of an object, or to find shapes with a common area. That is, using graph paper as a measuring tool counts as a use of physical materials.

Example -

T: Okay looks like everybody is on the right track. Looking good. Okay just stop. What were the dimensions of your page please Jay, what were the dimensions of your page?
S: Huh?
T: We’re talking about the length and the width or the height and the length, whichever way you like to describe it.
S: It was 20cm x 28,

In Table 29, observations recorded for each lesson are presented. For descriptive purposes, the percentage of public time coded for each lesson and the lesson third which contained the largest episode of public time is also recorded.

The ToMOS score for each teacher, determined by the number of different teacher actions observed during the two lessons, is presented in Table 30. Each dimension is scored separately and the scores are combined to give a total score. With all the limitations of using an adjusted class residual to indicate teaching effectiveness, as highlighted in Phase 2 of this research project, the order of teaching effectiveness is indicated by an ordering of class residuals in Table 30.

Given the small sample size, assumptions of normality and scaled scores cannot be met so a non-parametric test of correlation using Spearman’s Rank Correlation Coefficient was applied. The results indicated a moderate strength relationship between ToMOS scores and class residuals that was approaching significance (rho=.647, p=.060). A notable outlier in ToMOS scores was that calculated for Teacher 5. Removing this data from the analysis produced results indicating a significant and strong relationship between ToMOS scores and class residuals (rho=.747, p=.033).
### Table 29

**Pilot test results**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>% Public</th>
<th>Seg. public</th>
<th>EMEA</th>
<th>MSOL</th>
<th>SUMM</th>
<th>MISC</th>
<th>MLAN</th>
<th>MREP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45.0</td>
<td>91.6</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>55.0</td>
<td>54.2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>60.0</td>
<td>61.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>64.4</td>
<td>19.4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>56.4</td>
<td>51.9</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td>87.0</td>
<td>60.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7</td>
<td>24.2</td>
<td>22.5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>35.1</td>
<td>29.8</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Note. A tick indicates the particular teaching action was observed at least once during the lesson.*

### Table 30

**Summary of pilot test results**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Class residual</th>
<th>Communicates expectations /4</th>
<th>Conceptual understanding /6</th>
<th>TOTAL /10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>26.30</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>22.79</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>13.17*</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>11.21*</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>9.56</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Teacher 6</td>
<td>3.03*</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Teacher 7</td>
<td>-2.92*</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Teacher 8</td>
<td>-5.93</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Teacher 9</td>
<td>-6.42*</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note. An asterix denotes residual was averaged over two classes.*
6.3 DISCUSSION

There are few instruments that have been developed to measure teaching quality based on observed classroom practice. The ToMOS was developed in response to the need to measure teaching quality in lower secondary mathematics classrooms, enabling future research to validate findings and theories of effective mathematics teaching. While further testing of the ToMOS is required, pilot-testing of the ToMOS indicated it to be an instrument with good inter-rater reliability and a significant rank correlation was found between the ToMOS score and a measure of teaching effectiveness (based on student achievement gains). The ToMOS is designed to also be a practical reflective tool for mathematics in-service and preservice teachers, who can use it to critically analyse their use of public time. The ToMOS also provides a useful measure to compare programs designed to improve the quality of teaching in secondary mathematics classrooms.

To validate theories of effective teaching it is imperative that measures of teaching quality are found to explain variance in measures of teaching effectiveness. It makes good sense that measures of teaching effectiveness be linked in some way to student learning outcomes. While the focus of this research project was on developing a measure of teaching quality, the design of the pilot test incorporated a measure of teaching effectiveness that was based on student achievement gains. The secondary school setting for this research project provided an interesting scenario for a multilevel analysis of student achievement gains that is generally not present in the primary school setting; that is, teachers often teach more than one class at the same level. The findings revealed considerable variance in estimates of student achievement gains between different classes taught by the same teacher, that appeared to be influenced by the initial achievement level of the classes. This highlights the caution required when making any claim that highly effective classrooms (based on student achievement gains) can be used to identify highly effective teachers — or the opposite claim, that ineffective classrooms can be used to identify ineffective teachers. The current debate on performance pay is based on this claim.

A widening of the achievement gap between initially low performing students and high performing students in mathematics was evident in the transition from primary school to the end of the first year in secondary school. A significant correlation between class residuals and mean Year 7 achievement scores confirmed that this was occurring at the class level. The implications of this finding are outlined in the final section of this report.
7. OVERVIEW AND IMPLICATIONS

Teaching for Growth has explored the relationship between children’s growth in literacy and numeracy and teachers’ classroom teaching practices. It comprises two related studies: a study of teachers’ practices and children’s growth in literacy in Pre-primary and Year 1 and a study of teachers’ practices and children’s growth in numeracy in Year 8.

Both studies built directly on the methods, instruments and results of a previous study, In Teachers’ Hands (Louden et al, 2005). In Teachers’ Hands established a relationship between average growth in class groups of children’s literacy scores and the presence of particular teaching practices in follow-up case studies of their classroom teachers. Whereas the earlier study was a national study of growth in literacy in the first and second years of formal schooling and drew data from all school sectors, Teaching for Growth focuses on growth in numeracy as well as literacy, and draws its data from Western Australian Government schools.

7.1 GROWTH IN LITERACY IN PRE-PRIMARY AND YEAR 1

Study 1, the literacy study, used the same assessment strategy as In Teachers’ Hands, with value-added growth scores calculated on a basis of growth between scores on ACER’s LLANS literacy scale from March to November. Data were collected from children in the Pre-primary year and in Year 1. In Western Australia, Pre-primary education is full-time but not compulsory. Attendance is, however, almost universal. Approximately 95% of Year 1 children attend Pre-primary, typically in Pre-primary centres located on the campus of their primary schools. Year 1 is full-time and compulsory. Study 1 was completed in three broad phases: literacy assessment of children; classroom observation of teachers; and analysis of teaching practices associated with higher and lower levels of growth in literacy.

Phase 1: assessment

A representative sampling frame of 100 schools yielded 1,127 Pre-primary and 1,058 Year 1 children in 171 separate classrooms. The average age of Pre-primary children on February 1, 2005, just before the first round of assessment, was five years and two months; the average age of year 1 children at that time was six years and two months. Assessment of these children in March and November of 2005 revealed that:

- In Pre-primary, there was relatively little growth for low-performing children and a large amount of growth for high-performing children.
- In Year 1, large amounts of growth were observed for both low-performing and high-performing children.
- Compared with a national sample of children in government schools assessed when they were approximately the same age with the same instrument in 1999, Western Australian children’s performance was significantly lower. The gaps in performance were smaller at the end of Year 1 than they were at the beginning and end of Pre-primary and at the beginning of Year 1, but they were significantly lower at each assessment point.
- Average growth in Year 1 was approximately two and a half times greater than average growth in Pre-primary for WA children; average growth in the 1999 national sample was not significantly different from Pre-primary to Year 1.
- Western Australian Pre-primary children found some kinds of assessment items concerning sight words more difficult than children in the 1999 national LLANS sample.

To estimate children’s learning gains after taking account of predictors of children’s performance, multi-level statistical models were fitted to the literacy data for each of the Pre-primary and Year 1 samples. After accounting for the impact of prior performance, disability, interruption to learning, relative attentiveness and Aboriginal or Torres Strait islander status, value-added residuals were calculated for each of the class groups. On the basis of this analysis, teachers in these classes were allocated to one of three groups: teachers of classes that had achieved significantly higher growth than expected (‘more effective’), teachers whose classes had achieved as much growth as expected (‘effective’), and teachers whose classes had achieved significantly less growth than expected (‘less effective’).

Phase 2: classroom observation – quantitative analysis

Teachers from the more effective, effective and less effective groups were approached to participate in the classroom observation phase of the study in 2006. Nineteen Pre-
primary and Year 1 teachers agreed to participate, seven from the more effective groups, seven from the effective groups and five from the less effective groups. Schools represented the range of metropolitan and country locations and socio-economic status bands. A team of four (two researchers, a videographer and a sound recordist) visited each class for several days. The video and audio records were analysed using CLOS-R, a revised and improved version of the Classroom Literacy Observation Schedule (Louden & Rohl, 2003). CLOS-R identifies 27 literacy teaching practices that have been reported in the literature as being associated with effective teaching. Analysis of these data revealed that:

• CLOS-R has strong psychometric characteristics, effectively measuring the presence or absence of classroom teaching practices thought to be associated with effective teaching.
• After taking into account prior performance and other predictors of success, CLOS-R scores explain the majority of the remaining variance in student growth scores (r=0.87).
• There was a strong, and approximately linear, relationship between CLOS-R scores and LLANS value-added residual scores. (r = 0.93). That is, the higher the children’s growth in literacy, the more likely teachers were to have demonstrated most of the CLOS-R teaching practices.

Substantively, analysis of the CLOS-R data in conjunction with the evidence of student growth suggests that there is a continuum of development in literacy teaching practices. There are some low-level practices that all teachers demonstrated to some extent in their teaching practice, some that many demonstrated to some extent and some that only a few of the teachers with the highest student growth scores consistently demonstrated. Prospectively, then, if the educational improvement goal is to improve rates for student growth in literacy, the path to improvement seems to be to increase teachers’ capacity to use the teaching practices associated with moderate-growth and high-growth classes, whilst maintaining or developing consistent use of lower-level practices.

Phase 3: classroom observation – qualitative analysis

Quantitative differences in CLOS-R scores established in Phase 2 were investigated in more detail in Phase 3. From the video records of classroom teaching, 894 instances were identified for further investigation. Each of these instances had been coded for the presence of a subset of six teaching practices associated with literacy knowledge: (1) explanations at the word level, (2) explanations at the sentence level, (3) explanations at the text level, (4) support for the development of oral language, (5) understanding of the connections between oral and written language, and (6) use of metalanguage to make explicit children’s knowledge about language. For each of these teaching practices, each instance was compared with every other instance, with the goal of deciding which were the highest quality and which were the lowest quality instances of each teaching practice. Pair-wise analysis of these six sets of instances revealed that:

• There was a stronger focus on the development of oral language in the more effective teachers’ classrooms. They were more likely to integrate their oral language teaching into a theme and to develop context-specific vocabulary; to engage children in extended and scaffolded discussions; to provide opportunities for children to remember information, analyse, synthesise and evaluate information; and to provide targeted support to individuals.
• There was a more systematic focus on the explicit teaching of phonological awareness and phonics in the more effective teachers’ classrooms. They were more likely to be clear, precise and consistent in their use of metalinguistic terms, particularly ‘sounds’ and ‘letters’, and careful in their articulation of words and parts of words and in their explanation of rules, exceptions and definitions.
• Explanations at the syntactic (sentence) level were more frequent in the classrooms of more effective teachers, but the qualitative investigation of these sentence-level explanations did not reveal uniform differences between the groups of teachers.
• Text level discussions in the classrooms of the more effective teachers were more likely to involve higher order thinking. Their children were more likely to be familiar with a wide range of text types and to make
comparisons between texts and to critically analyse them. More effective teachers were more likely to provide scaffolding for children seeking information from non-fiction texts, and to make comparisons across texts to guide their children's own story writing.

• The more effective teachers were more likely to make clear and substantive connections for children between oral and written language. They were more likely to provide opportunities for extended conversations about written text and its conventions, to clarify subject specific vocabulary and concepts and to initiate extended conversations with their class about substantive features of written text. They were more likely to make clear connections between spoken and written language in terms of grapheme-phoneme correspondences and to model particular syntactic structures in both spoken and written forms.

• A wide variety of technical literacy-related vocabulary was more likely to be used by the more effective teachers as they engaged in extended and deep discussions about word level features including phonological awareness and phonics, sentence forms, comprehension of text, use of texts and critical analysis of text.

Literacy teaching issues arising from the study

A number of issues arise from the findings in this study that concern both the pattern of the Western Australian children's growth in literacy from the beginning of Pre-primary to the end of Year 1 and observed characteristics of Pre-primary and Year 1 classrooms.

During the Pre-primary year, the spread of literacy achievement increased, indicating that whilst some children had made substantial growth, others had made very little growth, with slower growth particularly noticeable at the bottom of the achievement distribution. In contrast, during Year 1, children demonstrated accelerated growth (approximately two and a half times that in Pre-primary) that was evident at all levels, including the bottom of the distribution.

Further, when compared to a previous national sample of government school children of approximately similar ages, who completed the same literacy assessments at the same times of the year, the literacy achievement of the Western Australian children was significantly lower at all assessment times, but by the end of Year 1 the gap between the groups had become much smaller. In this national sample there was not the large discrepancy in growth between the Pre-primary aged group and Year 1, with relatively similar growth during both years. Another finding was that the Western Australian Pre-primary children, who, at the end of the year scored lower as a group on all assessment items, found the reading of LLANS sight words, an essential literacy skill, to be particularly difficult.

Factors related to these findings

It appears that a number of factors may have interacted to produce these results about the nature of student literacy growth in Western Australian Pre-primary and Year 1 classrooms. Some of these factors became evident during the study as the researchers conducted interviews with the participating teachers and their school principals and made classroom observations.

Focus on literacy learning

In Year 1 it was clear from the observations and interviews that literacy learning was overwhelmingly the most important focus of the classroom. All Year 1 teachers indicated that the main outcome for their students during this school year was to learn to read and write. In all observed classrooms there was a daily morning time allocation of two or more hours for literacy in which there was sustained attention to literacy by teachers and children, that almost always involved direct teaching of reading and writing, some oral discussion of literacy tasks and some group and/or individual involvement in literacy tasks. There were, however, distinct differences in the ratio of direct teaching to individual engagement in literacy activities between the more effective and the effective and less effective teachers, with more whole group direct instruction in the more effective teachers' classes and some very long unbroken stretches of individual seat-work in the classrooms of effective and less effective teachers. Nevertheless, in spite of some differences of program implementation, there was a sustained drive for literacy in all the observed Year 1 classrooms.

In the Pre-primary teachers' classrooms, on the other hand, the researchers noticed a range of attitudes to literacy teaching and uncertainty by most as to what should be
taught and how. Some effective and less effective teachers expressed concern that the curriculum was being ‘pushed down’ and were apprehensive that social and emotional growth through play situations would be neglected if there were to be direct teaching of reading and writing in the Pre-primary year. The more effective Pre-primary teachers, on the other hand, whilst they were attentive to the children’s social and emotional growth, saw the Pre-primary year as having a strong foundational literacy focus that was a very important part of an ongoing sequence of literacy development.

Instead of the substantial allocated morning time slot for literacy teaching that was common to Year 1 classrooms, in many of the observed Pre-primary classrooms literacy-related activities, both planned and unplanned, were scattered throughout the day. These activities frequently involved bodily movement, excitement and noise and on many occasions were conducted by the teacher or assistant in small groups or individually, rather than in a class group. In addition to these features, in the more effective Pre-primary teachers’ classrooms there was also a strong emphasis on planned, direct, explicit literacy teaching and related discussion that took place in whole class or small groups. In these classrooms meaningful teaching time, that was adapted to children’s developmental levels, was maximised.

**Contextual factors**

The history and present structure of the Pre-primary year, in addition to teachers’ educational philosophies, may well have impacted on teachers’ beliefs and practices and consequently on children’s literacy learning. The two most populous states of Australia, New South Wales and Victoria, have compulsory full-time school education for children from the age of 5 years and the classrooms that these children enter are not very different from those of Year 1 children. Further, in these states there is the clear expectation, reflected in curriculum documents, that children will learn to read and write in this year of school. On the other hand, perhaps because of its non-compulsory nature and lack of clear direction in curriculum documents at the time of the study, the classroom observations made for this study showed the Western Australian Pre-primary experience, with one exception (a composite Pre-primary/Year 1 class), to be very different from that of Year 1.

**Implications for practice: equity**

The two main issues that arise from these findings are those of equity and how teachers might be enabled to create more literacy growth for all children in the early years of school, particularly in the Pre-primary year. In terms of equity there is much research showing that children who begin school with low levels of literacy knowledge are ‘at risk’ of developing literacy difficulties. There is also research showing that these children can benefit from targeted intervention, but that the timing of intervention, the earlier the better, helps determine its success (Ramey & Ramey, 2000). The fact that there appeared to be little progress at the lowest end of the achievement distribution over the Pre-primary year, strongly suggests that these children were being disadvantaged in Pre-primary classrooms that did not have a strong focus on literacy. Research evidence suggests that such ‘at risk’ children, who are most affected by the instruction of the teacher (Morrison et al., 2006) need explicit systematic teaching in the areas of phonological awareness and letter recognition and practice in using these skills in reading and writing (Ehri & Roberts, 2006; Rose, 2005). In the classrooms of the more effective Pre-primary teachers this explicit systematic teaching was usually conducted through meaningful, enjoyable routines and games that ensured active participation, showing that the explicit teaching of literacy was highly compatible with developmentally appropriate practice and helpful to all children, particularly those considered to be at risk. Further, in the classrooms of the more effective Pre-primary teachers where there was a strong literacy focus, children at all levels showed strong gains in literacy knowledge and skills that would be the foundation for later learning.

Another issue of equity most likely related to the slower rate of growth for Pre-primary children was the variable amount of time in Pre-primary classrooms in which literacy was given a specific focus. In some Pre-primary classrooms the researchers spent up to four days collecting many hours of video of teachers and children engaging in activities that the teachers claimed to be literacy-related. However, for the least effective Pre-primary teachers, it was difficult to find a full two hours of video that addressed any aspect of literacy, whilst the more effective Pre-primary teachers were engaged in substantial literacy teaching of various kinds for much of each day.

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Implications for practice: creating more literacy growth for all children

The classroom observations clearly showed a very strong relationship between children’s literacy growth and teachers’ classroom practices. The more effective teachers demonstrated more of the CLOS-R practices more often and, for the literacy knowledge practices examined in the pair-wise analysis, at higher levels of quality. The less effective teachers demonstrated fewer of the practices less often and, when they were demonstrated, the knowledge practices subjected to pair-wise analysis were often of lower quality. The results of Rasch analysis showed a continuum of teaching practices from frequently to infrequently observed. All classrooms visited showed relatively high levels of the practices at the lower end of the continuum, that is, respect in terms of rapport, teacher credibility and citizenship, and also attention by the children, showing that all the Pre-primary and Year 1 teachers had created classrooms that were pleasant to be in and in which children were focussed to a greater or lesser extent on literacy tasks. Literacy activities in most classrooms often began with a sense of purpose and teachers provided some stimulation for children to participate.

The more effective and most of the effective teachers demonstrated relatively consistent use of the mid-level practices of making connections for children between spoken and written language, using appropriate metalanguage, awareness of the needs of children, and providing substantial and structured literacy learning experiences. The mid- to higher-level practices demonstrated with some consistency by the more effective and several of the effective teachers were explicitly focussing on word-level concepts and skills, appropriate pacing of lessons, scaffolding of children, persistently revisiting important literacy concepts, making effective use of transitions, providing timely and appropriate feedback, making clear connections between known and unknown concepts and skills and making productive use of the literate environment. Only the more effective teachers paid sustained attention to the highest-level practices, that is effectively developing children’s oral language, explaining text and sentence level-features, providing challenge, inclusion of all children through differentiation of instruction or resources, basing their teaching on assessment, teaching for independence and responding flexibly to children’s literacy contributions.

Improving teaching

These findings suggest that if teachers in early years classrooms are to create more literacy growth in the children in their classes they need to continue to incorporate into their teaching the practices identified as lower- and mid-level and to increase the quality of these practices. It is also important that they begin to include the mid-high and highest level practices. However, more effective teaching as observed in the classrooms of this study was dynamic and highly complex, in that the teachers used many CLOS-R practices simultaneously and seamlessly in a mix that was appropriate to the children in their classes. It could be helpful for teachers wishing to improve their practice to be given opportunities to observe and make guided analyses of the practices of more effective teachers and to relate this analysis to their own classroom situations.

Systematic approaches to literacy teaching

It also seems that in order to increase growth in the Pre-primary year for all children a more systematic approach to literacy teaching is indicated, with more time specifically allocated to focussed explicit teaching. This explicit teaching will need to address phonological awareness, phonics and word recognition, in addition to text and sentence level concepts, and to have a strong focus on extending oral language and making connections between oral and written language. Resources for teachers that include specific guidelines for literacy assessment of children and for planning and implementing literacy teaching, would give teachers more certainty about the effective use of focussed literacy time and help schools plan for literacy across early years classes.

Continuity of literacy experience

It would also be helpful if these resources were to include guidelines for continuity of literacy teaching practice between Pre-primary and Year 1 that would ensure developmentally appropriate practice at both year levels.

The long unbroken stretches of individual seatwork with little teacher feedback observed in some of the Year 1 classrooms were very difficult for some children and were in direct contrast with the vitality apparent in most of the Pre-primary classrooms in which children regularly moved between activities and there were many opportunities for
self-directed multi-sensory experiences and play.

Continuity of practice, which combined the strong literacy focus of Year 1 with the energetic variety of Pre-primary, was clearly shown in the classroom of the highly effective teacher who taught a composite Pre-primary/Year 1 class. In this classroom both Pre-primary and Year 1 children were exposed to the explicit teaching of literacy appropriate to their levels of development and were also given access to opportunities for socio-dramatic play and other self-chosen activities. Indeed, all the more effective teachers observed in this study, whether Pre-primary or Year 1, showed evidence of taking into account the developmental levels of children as they broke up literacy tasks into smaller parts, gave regular group as well as individual feedback and used a wide variety of teaching techniques appropriate to children’s levels of development that ensured the active participation of all children and continued literacy growth.

7.2 GROWTH IN NUMERACY IN YEAR 8

Study 2 extended the methods used in the literacy study to a new domain, Year 8 numeracy. Although the mathematics education literature contains many studies that attempt to explain teacher effects, such studies are largely based on teacher self reports and, to a lesser extent, on expert ratings of observed practice where the observation criteria are not made explicit. Unlike Study 1, which could begin with an established observation instrument, the first phase of Study 2 was to develop an observation schedule to provide a measure of teaching quality. The second phase involved assessment of students’ growth in numeracy. The third phase involved pilot testing the observation schedule and examining the strength of the relationship between teaching quality and teaching effectiveness.

Phase 1: development of the classroom observation instrument

A synthesis of the literature on classroom practices identified eight themes that have been linked to effective mathematics teaching:

- Choice of task.
- Student thinking.
- Consolidation.
- Systematic development of content.
- Making connections.
- Direct teaching.
- Language.

The Teaching of Mathematics Observation Scale was designed to fit some of the practical constraints that shaped the study. Explorations with potential classroom observation sites demonstrated that Year 8 mathematics teachers were much more reluctant than early years literacy teachers to participate in a study involving audio or video recording. For this reason, the decision was made to develop an instrument that could be scored reliably in situ rather than relying on digital recording. For ease of in situ scoring, it was also decided to restrict scoring to parts of lessons when teachers and students were involved in public (rather than private) interaction. A third constraint, the total number of actions that an observer could be expected to attend to during in situ observation, led to the decision to limit coding to ten teaching practices.

Phase 2: estimating Year 8 student achievement gains

A convenient random sample of 24 schools was chosen to represent the range of contexts in Western Australian secondary schools. The sample included 2,864 students in 132 classes taught by a total of 95 teachers. Students were assessed in late October/early November 2005 using secure items from the WA Literacy and Numeracy Assessment (WALNA) item bank. Analysis of the results of these assessments revealed that:

- In Year 8, there was relatively more growth for high performing students than low performing students. Average growth on the WAMSE scale was 37 points at the 90th percentile, 17 points at the 25th percentile and 19 points at the 10th percentile.

To estimate students’ achievement gains in mathematics after taking account of prior performance, the same statistical procedures were used in Study 2 as Study 1. Three groups of classes were identified: a more effective group, an effective group and a less effective group. Analysis of these results showed that:

- All eleven of the more effective classes were located in metropolitan schools, eight were in schools with SEI scores greater the 100, and ten classes had a Year 7 class mean above or well above the grand mean for the study cohort.
- Three of the less effective classes were in rural schools, only one was in a school with an SEI greater than 100, and none of the classes had a Year 7 class mean above the grand mean for the study cohort.
- Teachers who produced a high residual in one Year 8 class did not necessarily produce a high residual in another Year 8 class. Teachers were generally more effective with initially higher achieving classes.
Phase 3: pilot testing the ToMOS

Teachers of the more effective and effective classes were approached to participate in the classroom observation phase of the study in 2006. Nine teachers agreed to participate. Two researchers and (where appropriate) a videographer visited two non-consecutive lessons. The two researchers, who had developed and tested the coding manual for the ToMOS, scored teachers’ public time in situ for each five minute segment of each lesson. The results indicated that:

- ToMOS is a reliable scale, showing high levels of inter-rater reliability during pilot testing.
- There is a moderately strong relationship ($\rho = 0.647$, $p = 0.06$) between ToMOS scores and WALNA value-added residual scores. Removal of a single outlying score would imply a strong significant relationship between ToMOS scores and residuals ($\rho = 0.747$, $p = 0.033$).

Numeracy teaching issues arising from the study

Although teachers, schools, and education departments are more accountable for their effectiveness at improving student outcomes and so are under more pressure to improve the quality of teaching, a close examination of research in mathematics education reveals that few published studies have actually examined the strength of the relationship between teacher traits or characteristics of teaching practices commonly associated with teaching quality or excellence, and teaching effectiveness. A limiting factor has been the development of appropriate measures of teaching quality and teaching effectiveness.

The ToMOS was developed in response to the need to have a measure of teaching quality that is based on observable practice. While further testing is required, pilot-testing of the ToMOS indicates that mathematics teachers wanting to improve their own effectiveness will do so if they incorporate more actions identified in the ToMOS into their teaching practice.

Issues and implications

This study found a widening of the achievement gap between classes with initially lower performing students and classes with initially higher performing students. Contemporary value added models, like the one used in this study, allow researchers to partition variance in student achievement gains into levels, including student and class levels, and thus focus on the class level to provide a measure of teaching effectiveness (referred to this analysis as the class residual). It is not surprising that students’ initial achievement predicts their future achievement at the student level but it is surprising to find that mean initial achievement scores for the class were found to explain a significant amount of variance in achievement gains at the class level.

There are many possible factors why classes with generally lower achieving students may not be learning at the same rate as classes of generally higher achieving students. The secondary school setting for this research project provided an interesting scenario for a multilevel analysis of student achievement gains as many participating teachers were teaching more than one Year 8 maths class; the findings revealed considerable variance in estimates of student achievement gains between different classes of students taught by the same teacher. Although it is beyond the scope of this report to examine in any detail possible factors operating at the classroom level that could explain this widening of the achievement gap, one factor does stand out as being important to mention. As well as substantial variation of student achievement levels within most classes in the study (most were not streamed), there was also striking variation in student achievement levels between classes and schools. It should be expected that the mathematical content and outcomes addressed in one Year 8 class of mostly higher achieving students would be very different to the mathematical content and outcomes addressed in another Year 8 class of mostly lower achieving students. The instructional content must be aimed at the appropriate level if students are to be able to make meaningful connections between what they know and understand, and what they are taught. While it is reasonable to expect classes of students to learn at the same rate, regardless of their initial achievement levels (providing a scale measure of achievement is used), classes will not learn at the same rate, regardless of the quality of teaching actions, if the instructional content is not appropriate for the student population. This is one possible factor that could explain why classes may not be learning at the same rate.

To validate theories of mathematics teaching in lower secondary classrooms, it is imperative that what is accepted and promoted as quality teaching can be shown to account for student achievement gains. Given
the complexities involved in teaching lower secondary mathematics and all that pedagogy entails, it is unlikely that a single measure of teaching quality will account for all variance in student achievement gains at the classroom level. A measure of teachers’ pedagogical knowledge for teaching mathematics (Hill, Rowan, Lowenberg Ball, 2005) is important for measuring teaching quality. Similarly an observational measure of teaching practice in action, like the ToMOS, is imperative. The importance of a third measure, one that represents the ‘distance’ between the instructional content as it is taught and a classes’ capacity to make meaningful connections with the content, has also emerged. Further research is needed to examine how much variance in student achievement gains can be explained at the class level using these and possibly other measures, and how much variance remains to be explained.

**Practical applications**

Robust instruments for examining teaching quality have many practical applications. For example, the ToMOS can be used as a reflective tool for preservice mathematics teachers, who can use it to critically analyse their use of public time based on a videotape of themselves in action. The consistency and type of feedback provided to preservice teachers during practicum can vary markedly and students’ reflective self-reports of their practicum experience may also vary in terms of the depth and importance of the issues reflected upon. The actions identified in the ToMOS will help preservice teachers to focus, from the beginning of their development as a teacher, on the quality of their teaching. Similarly the ToMOS can be used as a reflective tool for current mathematics teachers who are looking to improve their own effectiveness or as a reporting tool, as part of a portfolio, for establishing teaching expertise.


Rowan, B., Correnti, R., Miller, R. J. (2002). What large-scale, survey research tells us about teacher effects on student achievement: Insights from the Prospects Study of elementary schools. Teachers College Record, 101(8), 1525-1567.


Figure A1.1 Pre-primary literacy item estimates for Term 4

Each X represents 4 students
<table>
<thead>
<tr>
<th>Item code</th>
<th>Item description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2HS2</td>
<td>Retells narrative in a picture story book</td>
</tr>
<tr>
<td>2HS3</td>
<td>Gives plausible reason for title of picture story book</td>
</tr>
<tr>
<td>2HS4</td>
<td>Describes events shown in an illustration</td>
</tr>
<tr>
<td>2HS5</td>
<td>Identifies and explains key event in a picture story book</td>
</tr>
<tr>
<td>2HS6</td>
<td>Identifies characters’ emotions from an illustration after listening to a picture story book</td>
</tr>
<tr>
<td>2HS7</td>
<td>Interprets meaning in illustrative technique in a picture story book</td>
</tr>
<tr>
<td>2HS8</td>
<td>Identifies presence and significance of an object in illustration</td>
</tr>
<tr>
<td>2HS9</td>
<td>Gives reason for use of illustrative technique in a picture story book</td>
</tr>
<tr>
<td>2HW1</td>
<td>Writes own name correctly</td>
</tr>
<tr>
<td>2HW2</td>
<td>Reads own writing</td>
</tr>
<tr>
<td>2HW3</td>
<td>Matches reading to own writing</td>
</tr>
<tr>
<td>2HW4</td>
<td>Reads own writing and writing relates to specific illustration from picture story book</td>
</tr>
<tr>
<td>2HW5</td>
<td>Writes one or more generally readable sentences</td>
</tr>
<tr>
<td>2HW6</td>
<td>Writing includes capital letters and/or full stops</td>
</tr>
<tr>
<td>2OB1</td>
<td>Connects words to related chart</td>
</tr>
<tr>
<td>2OB2</td>
<td>Identifies single word label by linking to an illustration (nose)</td>
</tr>
<tr>
<td>2OB3</td>
<td>Identifies single word label by linking to an illustration (toe)</td>
</tr>
<tr>
<td>2OB4</td>
<td>Reads a single word label by linking to an illustration (ear)</td>
</tr>
<tr>
<td>2OB5</td>
<td>Reads a single word label by linking to an illustration (hand)</td>
</tr>
<tr>
<td>2OB6</td>
<td>Reads a single word label by linking to an illustration (chin)</td>
</tr>
<tr>
<td>2OB7</td>
<td>Names missing word from label on chart (foot)</td>
</tr>
<tr>
<td>2OB8</td>
<td>Identifies missing word from group of words on chart (foot)</td>
</tr>
<tr>
<td>2OB9</td>
<td>Names missing word from label on chart (arm)</td>
</tr>
<tr>
<td>2OBa</td>
<td>Identifies missing word from group of words on chart (arm)</td>
</tr>
<tr>
<td>2OBb</td>
<td>Reads simple common words from labels on a chart</td>
</tr>
<tr>
<td>2WS2</td>
<td>Identifies words with the same first sound from a list of three (rat, sun, sink)</td>
</tr>
<tr>
<td>2WS3</td>
<td>Identifies words with the same first sound from a list of three (fish, web, feet)</td>
</tr>
<tr>
<td>2WS4</td>
<td>Identifies words with the same first sound from a list of three (man, mud, goat)</td>
</tr>
<tr>
<td>2WS5</td>
<td>Identifies words with the same first sound from a list of three (steak, tray, tree)</td>
</tr>
<tr>
<td>2WS6</td>
<td>Identifies ‘k’ sound at the end of bike</td>
</tr>
<tr>
<td>2WS7</td>
<td>Identifies ‘g’ sound at the end of bag</td>
</tr>
<tr>
<td>2WS8</td>
<td>Identifies ‘p’ sound at the end of pup</td>
</tr>
<tr>
<td>2WS9</td>
<td>Identifies ‘t’ sound at the end of coat</td>
</tr>
<tr>
<td>2WSa</td>
<td>Identifies ‘d’ sound at the end of bird</td>
</tr>
<tr>
<td>2WSb</td>
<td>Identifies sounds for each letter in a three letter word (pig)</td>
</tr>
<tr>
<td>2WSC</td>
<td>Identifies sounds for each letter in a three letter word (bus)</td>
</tr>
<tr>
<td>2WSd</td>
<td>Identifies sounds for each letter in a three letter word (ten)</td>
</tr>
<tr>
<td>2WSf</td>
<td>Identifies sounds in the word ‘kick’</td>
</tr>
<tr>
<td>2WSg</td>
<td>Identifies words that rhyme from given pairs (snake, cake; snake, stick; snake, brake)</td>
</tr>
<tr>
<td>2WSh</td>
<td>Identifies words that rhyme from given pairs (hand, bed; hand, sand; hand, horse)</td>
</tr>
<tr>
<td>2WSi</td>
<td>Identifies words that rhyme from given pairs (bunny, money; bunny, balloon; bunny, funny)</td>
</tr>
<tr>
<td>2WSj</td>
<td>Names words that rhyme with a given word (cap)</td>
</tr>
<tr>
<td>2WSk</td>
<td>Names words that rhyme with a given word (lunch)</td>
</tr>
<tr>
<td>2WSm</td>
<td>Names words that rhyme with a given word (nest)</td>
</tr>
<tr>
<td>2LS2</td>
<td>Names a letter (a)</td>
</tr>
<tr>
<td>2LS3</td>
<td>Names a letter (l)</td>
</tr>
<tr>
<td>2LS4</td>
<td>Names a letter (s)</td>
</tr>
<tr>
<td>2LS5</td>
<td>Names a letter (m)</td>
</tr>
<tr>
<td>2LS6</td>
<td>Names a letter (p)</td>
</tr>
<tr>
<td>2LS7</td>
<td>Names a letter (e)</td>
</tr>
<tr>
<td>2LS8</td>
<td>Names a letter (k)</td>
</tr>
<tr>
<td>2LS9</td>
<td>Names a letter (b)</td>
</tr>
<tr>
<td>2LS0</td>
<td>Names a letter (g)</td>
</tr>
<tr>
<td>2LSa</td>
<td>Names a letter (r)</td>
</tr>
<tr>
<td>2LSb</td>
<td>Names a letter (f)</td>
</tr>
<tr>
<td>2LSc</td>
<td>Names a letter (t)</td>
</tr>
<tr>
<td>2LSd</td>
<td>Makes the sound of a letter (a)</td>
</tr>
<tr>
<td>2LSf</td>
<td>Makes the sound of a letter (l)</td>
</tr>
<tr>
<td>2LSg</td>
<td>Makes the sound of a letter (s)</td>
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<tr>
<td>2LSh</td>
<td>Makes the sound of a letter (m)</td>
</tr>
<tr>
<td>2LSi</td>
<td>Makes the sound of a letter (p)</td>
</tr>
<tr>
<td>2LSj</td>
<td>Makes the sound of a letter (e)</td>
</tr>
<tr>
<td>2LSk</td>
<td>Makes the sound of a letter (k)</td>
</tr>
<tr>
<td>2LSl</td>
<td>Makes the sound of a letter (b)</td>
</tr>
<tr>
<td>2LSm</td>
<td>Makes the sound of a letter (g)</td>
</tr>
<tr>
<td>2LSn</td>
<td>Makes the sound of a letter (r)</td>
</tr>
<tr>
<td>2LSp</td>
<td>Makes the sound of a letter (f)</td>
</tr>
<tr>
<td>2LSq</td>
<td>Makes the sound of a letter (t)</td>
</tr>
<tr>
<td>2SW2</td>
<td>Reads 'and' as a sight word</td>
</tr>
<tr>
<td>2SW3</td>
<td>Reads 'the' as a sight word</td>
</tr>
<tr>
<td>2SW4</td>
<td>Reads 'I' as a sight word</td>
</tr>
<tr>
<td>2SW5</td>
<td>Reads 'my' as a sight word</td>
</tr>
<tr>
<td>2SW6</td>
<td>Reads 'you' as a sight word</td>
</tr>
<tr>
<td>2SW7</td>
<td>Reads 'is' as a sight word</td>
</tr>
<tr>
<td>2SW8</td>
<td>Reads 'are' as a sight word</td>
</tr>
<tr>
<td>2SW9</td>
<td>Reads 'so' as a sight word</td>
</tr>
<tr>
<td>2SW0</td>
<td>Reads 'do' as a sight word</td>
</tr>
<tr>
<td>2SWa</td>
<td>Reads 'from' as a sight word</td>
</tr>
<tr>
<td>2SWb</td>
<td>Reads 'one' as a sight word</td>
</tr>
<tr>
<td>2SWc</td>
<td>Reads 'little' as a sight word</td>
</tr>
<tr>
<td>2SWd</td>
<td>Reads 'thing' as a sight word</td>
</tr>
<tr>
<td>2SWe</td>
<td>Reads 'morning' as a sight word</td>
</tr>
<tr>
<td>2SWf</td>
<td>Reads 'because' as a sight word</td>
</tr>
<tr>
<td>2SWg</td>
<td>Reads 'would' as a sight word</td>
</tr>
<tr>
<td>2MR1</td>
<td>Predicts story for a simple reading book after looking at cover</td>
</tr>
<tr>
<td>2MR2</td>
<td>Identifies the title of a simple reading book</td>
</tr>
<tr>
<td>2MR3</td>
<td>Reads title of a simple reading book</td>
</tr>
<tr>
<td>2MR5</td>
<td>Reads a simple reading book</td>
</tr>
<tr>
<td>2MR6</td>
<td>Self-corrects while reading a simple reading book</td>
</tr>
<tr>
<td>2MR7</td>
<td>Explains key events in a simple reading book read independently</td>
</tr>
<tr>
<td>2MR8</td>
<td>Explains key events in a simple reading book read independently</td>
</tr>
<tr>
<td>2PC1</td>
<td>Identifies a word from a page of text</td>
</tr>
<tr>
<td>2PC2</td>
<td>Identifies a letter from a page of text</td>
</tr>
<tr>
<td>2PC3</td>
<td>Identifies a given word from a simple reading book</td>
</tr>
<tr>
<td>2PC4</td>
<td>Identifies letters in a given word from a simple reading book</td>
</tr>
<tr>
<td>2PC5</td>
<td>Identifies a full stop</td>
</tr>
<tr>
<td>2PC6</td>
<td>Knows purpose of a full stop</td>
</tr>
<tr>
<td>2PC7</td>
<td>Identifies a question mark</td>
</tr>
<tr>
<td>2PC8</td>
<td>Knows purpose of a question mark</td>
</tr>
<tr>
<td>2PC9</td>
<td>Knows purpose of a quotation mark</td>
</tr>
</tbody>
</table>
### Figure A1.2 Year 1 literacy item estimates Term 1

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<th>3KS4.3</th>
<th>3MW1.4</th>
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<td>3SS6.3</td>
</tr>
<tr>
<td></td>
<td>3MW2.4</td>
<td>3MW4.3</td>
</tr>
<tr>
<td>2.0</td>
<td>X</td>
<td>3SS4.3 3SS5.3 3IW8 3MW1.3</td>
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<tr>
<td></td>
<td>X</td>
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</tr>
<tr>
<td></td>
<td>X</td>
<td>3IW7   3MW3.3 3MW4.2</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>3KC7</td>
</tr>
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<tr>
<td>XXX</td>
<td></td>
<td>3SS3.3 3IW4 3IW5</td>
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<td>1.0</td>
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</tr>
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<td></td>
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<td></td>
<td>XXXXXXX</td>
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</tr>
<tr>
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<tr>
<td></td>
<td>XXXXXXX</td>
<td>3KC6   3KS1.2 3IW1 3MB8 3MW3.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXXX</td>
<td>3MW2.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXXX</td>
<td>3KS3.1 3KS4.1 3MW1.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXXX</td>
<td>3KS1.4 3KS2.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXXX</td>
<td>3SS1   3MB2.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXXX</td>
<td>3MB7.2</td>
</tr>
<tr>
<td>-2.0</td>
<td>XXXXXXXXX</td>
<td>3MB9.1</td>
</tr>
<tr>
<td></td>
<td>XXXXXX</td>
<td>3MB1.1 3MB6.1</td>
</tr>
<tr>
<td></td>
<td>XXXX</td>
<td>3MB4.1</td>
</tr>
<tr>
<td></td>
<td>XX</td>
<td>3MB7.1</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>3KC1.1</td>
</tr>
<tr>
<td>-3.0</td>
<td>X</td>
<td>3MB7.1</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>3KC1.1</td>
</tr>
<tr>
<td>-4.0</td>
<td>X</td>
<td>3MB7.1</td>
</tr>
</tbody>
</table>

Each X represents 5 students.
<table>
<thead>
<tr>
<th>Item code</th>
<th>Item description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3KC1</td>
<td>Predicts content after looking at the front cover of a simple picture story book (Kitty Cat Plays Inside)</td>
</tr>
<tr>
<td>3KC2</td>
<td>Reads the title of a simple picture book</td>
</tr>
<tr>
<td>3KC3</td>
<td>Reads all or most of a simple picture story book with moderate accuracy</td>
</tr>
<tr>
<td>3KC4</td>
<td>Identifies and reads words that a character says in a picture story book</td>
</tr>
<tr>
<td>3KC5</td>
<td>Gives plausible motive for a character’s behaviour in a simple picture story book</td>
</tr>
<tr>
<td>3KC6</td>
<td>Offers opinion and gives plausible reason concerning a character’s situation in a simple picture story book</td>
</tr>
<tr>
<td>3KC7</td>
<td>Recognises and names quotation marks</td>
</tr>
<tr>
<td>3KC8</td>
<td>Describes purpose of quotation marks</td>
</tr>
<tr>
<td>3KS1</td>
<td>Spells and writes high frequency words with a range of patterns (big)</td>
</tr>
<tr>
<td>3KS2</td>
<td>Spells and writes high frequency words with a range of patterns (come)</td>
</tr>
<tr>
<td>3KS3</td>
<td>Spells and writes high frequency words with a range of patterns (played)</td>
</tr>
<tr>
<td>3KS4</td>
<td>Spells and writes high frequency words with a range of patterns (basket)</td>
</tr>
<tr>
<td>3SS1</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (sun)</td>
</tr>
<tr>
<td>3SS2</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (satin)</td>
</tr>
<tr>
<td>3SS3</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (sandal)</td>
</tr>
<tr>
<td>3SS4</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (seminar)</td>
</tr>
<tr>
<td>3SS5</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (satellite)</td>
</tr>
<tr>
<td>3SS6</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (sentimental)</td>
</tr>
<tr>
<td>3PA1</td>
<td>Manipulates sounds in words, e.g. takes out m in meat and make eat</td>
</tr>
<tr>
<td>3PA2</td>
<td>Manipulates sounds in words (bend/end)</td>
</tr>
<tr>
<td>3PA3</td>
<td>Manipulates sounds in words (card/car)</td>
</tr>
<tr>
<td>3PA4</td>
<td>Manipulates sounds in words (black/back)</td>
</tr>
<tr>
<td>3IW1</td>
<td>Reads words with a similar structure (like/bike)</td>
</tr>
<tr>
<td>3IW2</td>
<td>Reads words with a similar structure (like/hike)</td>
</tr>
<tr>
<td>3IW3</td>
<td>Reads words with a similar structure (like/spike)</td>
</tr>
<tr>
<td>3IW4</td>
<td>Reads words with a similar structure (like/strike)</td>
</tr>
<tr>
<td>3IW5</td>
<td>Reads words with a similar structure (like/likes)</td>
</tr>
<tr>
<td>3IW6</td>
<td>Reads words with a similar structure (like/liked)</td>
</tr>
<tr>
<td>3IW7</td>
<td>Reads words with a similar structure (like/likely)</td>
</tr>
<tr>
<td>3IW8</td>
<td>Reads words with a similar structure (like/likeness)</td>
</tr>
<tr>
<td>3IW9</td>
<td>Spells and writes a given word (bike)</td>
</tr>
<tr>
<td>3IW0</td>
<td>Spells and writes a given word (liked)</td>
</tr>
<tr>
<td>3MB1</td>
<td>After listening to a picture story book identifies main idea in a retelling (Magical Bicycle)</td>
</tr>
<tr>
<td>3MB2</td>
<td>Explains a story complication and resolution in a picture story book</td>
</tr>
<tr>
<td>3MB3</td>
<td>Identifies a key detail in a picture story book</td>
</tr>
<tr>
<td>3MB4</td>
<td>Makes a link between illustration, text and narrative in a picture story book</td>
</tr>
<tr>
<td>3MB5</td>
<td>Recognises and interprets meaning behind an illustration in a picture story book</td>
</tr>
<tr>
<td>3MB6</td>
<td>Links images and text to construct meaning from own reading and listening to a picture story book</td>
</tr>
<tr>
<td>3MB7</td>
<td>Links images and text to construct meaning from own reading and listening to a picture story book</td>
</tr>
<tr>
<td>3MB8</td>
<td>Recognises and interprets meaning behind an illustration in a picture story book</td>
</tr>
<tr>
<td>3MB9</td>
<td>Makes a generalisation about an illustration at the conclusion of a picture story book</td>
</tr>
<tr>
<td>3MW1</td>
<td>Writes a well connected extended piece that shows the beginning of a recognisable structure e.g. Recount, narrative</td>
</tr>
<tr>
<td>3MW2</td>
<td>Writing includes one or more complex sentences</td>
</tr>
<tr>
<td>3MW3</td>
<td>Writing is very readable with many words spelt correctly</td>
</tr>
<tr>
<td>3MW4</td>
<td>Writing included several sentences with capital letters and full stops used consistently and accurately</td>
</tr>
</tbody>
</table>
WA growth study (Year 1 Term 4 anchored on LLANS S4)

Item Estimates (Thresholds)

LitY1T4 (N = 1152 L = 48 Probability Level=0.50)

Each X represents 5 students

Figure A1.3 Year 1 literacy item estimates Term 2
<table>
<thead>
<tr>
<th>Item code</th>
<th>Item description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4ST1</td>
<td>Gives relevant information from an informational book after hearing the text read aloud (Size of Sea Turtle)</td>
</tr>
<tr>
<td>4ST2</td>
<td>Gives relevant information from an informational book after hearing the text read aloud (Sea Turtles' Mouths)</td>
</tr>
<tr>
<td>4ST3</td>
<td>Gives relevant information from an informational book after hearing the text read aloud (What Sea Turtles Eat)</td>
</tr>
<tr>
<td>4ST4</td>
<td>Identifies relevant title for information box after hearing related text read aloud</td>
</tr>
<tr>
<td>4ST5</td>
<td>Identifies information from obvious clues in an informational book</td>
</tr>
<tr>
<td>4ST6</td>
<td>Uses context to provide meaning for an unfamiliar word in an informational text after hearing the text read aloud</td>
</tr>
<tr>
<td>4ST7</td>
<td>Identifies the purpose of a photo caption in an informational text</td>
</tr>
<tr>
<td>4ST8</td>
<td>Identifies from listening a specific in an informational text (How Seat Turtles Have Babies)</td>
</tr>
<tr>
<td>4ST9</td>
<td>Identifies from listening a specific in an informational text (Who Looks After Baby Sea Turtles)</td>
</tr>
<tr>
<td>4ST0</td>
<td>Locates explicit details from listening to an informational text</td>
</tr>
<tr>
<td>4STa</td>
<td>Provides generalised definition of glossary page</td>
</tr>
<tr>
<td>4STb</td>
<td>Identifies purpose of repeated graphic element and connects to text</td>
</tr>
<tr>
<td>4STc</td>
<td>Recognises internet addresses of connects address with computer</td>
</tr>
<tr>
<td>4TW1</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (ten)</td>
</tr>
<tr>
<td>4TW2</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (tablet)</td>
</tr>
<tr>
<td>4TW3</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (ticket)</td>
</tr>
<tr>
<td>4TW4</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (target)</td>
</tr>
<tr>
<td>4TW5</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (tactical)</td>
</tr>
<tr>
<td>4TW6</td>
<td>Pronounces words that require segmenting of letters, blends and syllables (tetrahedron)</td>
</tr>
<tr>
<td>4PA1</td>
<td>Manipulates middle sounds in words e.g swaps h in hat with m to make mat</td>
</tr>
<tr>
<td>4PA2</td>
<td>Manipulates middle sounds in words e.g swaps c in camp with l to make lamp</td>
</tr>
<tr>
<td>4PA3</td>
<td>Manipulates middle sounds in words e.g swaps n in bin with g to make big</td>
</tr>
<tr>
<td>4PA4</td>
<td>Manipulates middle sounds in words e.g swaps t in art with m to make arm</td>
</tr>
<tr>
<td>4PA5</td>
<td>Manipulates middle sounds in words e.g swaps m in stem with p to make step</td>
</tr>
<tr>
<td>4PA6</td>
<td>Manipulates middle sounds in words e.g swaps u in cup with a to make cap</td>
</tr>
<tr>
<td>4PA7</td>
<td>Manipulates middle sounds in words e.g swaps o in shop with i to make ship</td>
</tr>
<tr>
<td>4PA8</td>
<td>Manipulates middle sounds in words e.g swaps m in smell with p to make spell</td>
</tr>
<tr>
<td>4PA9</td>
<td>Manipulates middle sounds in words e.g swaps l in blush with r to make brush</td>
</tr>
<tr>
<td>4SP1</td>
<td>Spells and writes a given word (his)</td>
</tr>
<tr>
<td>4SP2</td>
<td>Spells and writes a given word (plan)</td>
</tr>
<tr>
<td>4SP3</td>
<td>Spells and writes a given word (games)</td>
</tr>
<tr>
<td>4SP4</td>
<td>Spells and writes a given word (time)</td>
</tr>
<tr>
<td>4SP5</td>
<td>Spells and writes a given word (thin)</td>
</tr>
<tr>
<td>4SP6</td>
<td>Spells and writes a given word (running)</td>
</tr>
<tr>
<td>4SP7</td>
<td>Spells and writes a given word (great)</td>
</tr>
<tr>
<td>4SP8</td>
<td>Spells and writes a given word (basket)</td>
</tr>
<tr>
<td>4MM1</td>
<td>Identifies author and/or photographer names beneath title of informational book</td>
</tr>
<tr>
<td>4MM2</td>
<td>Reads some or all of a simple reading book with accuracy</td>
</tr>
<tr>
<td>4MM3</td>
<td>Identifies specific information in a simple informative reading book read independently (Purpose of Mouse Whiskers)</td>
</tr>
<tr>
<td>4MM4</td>
<td>Identifies specific information in a simple informative reading book read independently (Information About Teeth)</td>
</tr>
<tr>
<td>4MM5</td>
<td>Identifies specific information in a simple informative reading book read independently (Why Mice Chew)</td>
</tr>
<tr>
<td>4MM6</td>
<td>Locates specific information in a simple informative reading book read independently (Keeping Pet Mouse)</td>
</tr>
<tr>
<td>4MM7</td>
<td>Recognises purpose of ellipsis at the end of the page</td>
</tr>
<tr>
<td>4WR1</td>
<td>Writes with control and/or coherence in response to simple informative reading book</td>
</tr>
<tr>
<td>4WR2</td>
<td>Writes a variety of simple and complex sentences</td>
</tr>
<tr>
<td>4WR3</td>
<td>Writes readable text with correct or plausible spelling</td>
</tr>
<tr>
<td>4WR4</td>
<td>Uses full stops and capital letters consistently and accurately</td>
</tr>
<tr>
<td>4WR5</td>
<td>Uses a variety of common punctuation</td>
</tr>
</tbody>
</table>
### Activity Real Time (Note Start & End Time of an Activity) Grouping Whole (W) Small (S) Individual (I) Comments/Observations (if less than whole group what are the other children doing?) Description of activity - identify the likely literacy purpose and content.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Real Time (Note Start &amp; End Time of an Activity)</th>
<th>Grouping</th>
<th>Comments/Observations (if less than whole group what are the other children doing?)</th>
<th>Description of activity - identify the likely literacy purpose and content.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading</strong></td>
<td>8.44</td>
<td>W</td>
<td>Children arrive with parents who read with children. Parents, little kids. Teacher assistants and work experience students also reading with chn. All seem to have reading books. Children working on: reading to parents and teacher assistants; writing diary; initial letter games - sounds, word families, sight words. Busy and productive atmosphere.</td>
<td>Reading of home readers with folder 8.57 Teacher talks to researchers. Teacher working with individual children - hearing them read. Folder tracking reading when child is ready to move up a level, note is sent home to parents explaining purpose and aims of the next reading stage, and how the parents can work with the child. It’s billed as an exciting thing.</td>
</tr>
<tr>
<td><strong>Morning talk</strong></td>
<td>9.06</td>
<td>W</td>
<td>Tchr checks who hasn’t read yet (none), then puts on music - good morning song - this cues children to pack away and come to mat (no verbal instruction to do so)</td>
<td>Teacher talks about saying good morning to others when they first arrive. (She noted later that her background is in HR, and she feels it is important to encourage the chn to develop good people skills) Days of the week work - chn encouraged to use a whole sentence.</td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td>9.16</td>
<td>W</td>
<td>Note - Thursday schedule on white board. Vicki still pulling some children out one at a time to read</td>
<td>Teacher reads through schedule on white board. Question of the day - ‘Research’ - where - in a book, on the net - Google. Talks about their research topic - The Human Body.</td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td>9.21</td>
<td>W</td>
<td>Teacher introduces Reading Rotations - Each group works with an adult. Chn move to groups.</td>
<td></td>
</tr>
<tr>
<td><strong>Reading</strong></td>
<td>9.27</td>
<td>W</td>
<td>Teacher initially working with group (Ants) who can’t be filmed. (Mary took notes on other groups). Shared reading - 7 boys, 0 girls. Asks: What’s the book about? Looking at cover - what can we see? Reading title - how many words? 9.34 Opens Book - Children find where story starts. Teacher reading - invites chn to join in - sounds out some words - modelling - matching meaning of words with picture. What makes sense? Children read with teacher - teacher reads sentence, chn read after. Teacher points out quotation marks, but doesn’t name them. Very positive towards chn for talking and encouraging of their responses. Tchr asks questions - Why is this happening? Teacher also observing group at back, who are working with headphones and drawing. Incidental teaching of initial sounds. Teacher teasing chn about the last page - We don’t need to read that. Chn using tambourines to tap for each word in sentence “I’ll catch the dog”.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 3

Introduction to CLOS-R and the CLOS-R manual

The Classroom Literacy Observation Schedule – Revised (CLOS-R) was based on the Classroom Literacy Observation Schedule (CLOS) from the In Teachers’ Hands project (Louden & Rohl, 2003). CLOS was developed from an extensive literature review of effective teaching, effective teaching of literacy and early years literacy teaching. CLOS was reviewed for this study and as a result, overlapping teaching practices were consolidated, some practices were expanded, and some practices were added, changing it from 33 teaching practices in CLOS to 27 in CLOS-R. Items on CLOS & CLOS-R reflect literacy teaching practices, not literacy teaching activities.

A detailed manual was developed for CLOS-R to facilitate greater understanding of the 27 teaching practices. This manual outlines teaching practices that develop or extend literacy. The manual provides key indicators for each teaching practice, and gives examples of what that teaching practice could look like in the classroom. Some of these indicators refer to teacher behaviour, and some to the behaviour of the children. The manual was initially based on a draft manual from the In Teachers’ Hands project, and was extensively revised and refined during the initial pilot coding phase of Teaching for Growth. Minor changes were made during the coding process in order to clarify teaching practice definitions, as a result of observations of teachers and children, and discussions held amongst the research team during coding.

The manual was a valuable tool during the coding and pair-wise process, as it allowed members of the research team to develop a common understanding of teaching practices in both Year 1 and Pre-primary classrooms. During coding and pair-wise analysis, the manual was constantly referred to in order to ensure a clear understanding of each teaching practice, and therefore to enable consistency in coding, both among members of the research team and across teachers.

Inter-rater reliability

Each episode was coded by two members of the research team working together. In order to establish reliability among the four researchers, 28 episodes were coded twice, each time by a different pair of researchers. The number of teaching practices observed in each coding was recorded, and differences were noted. The average percentage of agreement between research pairs was 94%.
### Respect
1. Rapport
   - The teacher creates a warm, positive and inviting classroom where relationships with children encourage literacy learning.

2. Credibility
   - Children’s respect for the teacher enables her to maintain order and lesson flow.

3. Citizenship
   - The teacher promotes equality, tolerance, inclusively and awareness of the needs to others.

### Knowledge
4. Purpose
   - Children’s responses indicate tacit or explicit understanding of the purpose of the literacy task.

5. Substance
   - The teacher provides a lesson/task that leads to substantial literacy engagement, not busy work.

6. Explanation word
   - The teacher clearly explains specific word, letter or sound strategies or concepts.

7. Explanation sentence
   - The teacher clearly explains specific grammatical strategies or concepts.

8. Explanation text
   - The teacher clearly explains textual strategies or concepts.

9. Metalanguage
   - The teacher provides children with language for talking about and exemplifying literacy concepts.

10. Oral language
    - The teacher focuses on the development of children’s oral language.

11. Oral/written language
    - The teacher makes logical connections between oral and written language.

### Orchestration
12. Awareness
    - The teacher has a high level of awareness of literacy activities and participation by children.

13. Environment
    - The teacher uses the literate physical environment as a resource.

14. Structure
    - The teacher manages a predictable environment in which children understand consistent literacy routines.

15. Independence
    - Children take some responsibility for their own literacy learning.

16. Pace
    - The teacher provides strong forward momentum in literacy lessons.

17. Transition
    - The teacher spends minimal time changing activities or uses this time productively.

18. Attention
    - The teacher ensures that children are focused on the literacy task.

19. Stimulation
    - The teacher motivates interest in literacy through the creation of a pleasurable, enthusiastic and energetic classroom.

### Support
20. Assessment
    - The teacher uses fine-grained knowledge of children’s literacy performance in planning and teaching.

21. Scaffolding
    - The teacher extends literacy learning through reinforcement, modification or modelling.

22. Feedback
    - The teacher intervenes in timely, focused, tactful and explicit ways that support children’s literacy learning.

23. Responsiveness
    - The teacher is flexible in sharing and building on children’s literacy contributions.

24. Persistence
    - The teacher provides many opportunities to practise and master new literacy learning.

### Differentiation
25. Challenge
    - The teacher extends and promotes higher levels of thinking in literacy learning.

26. Inclusion
    - The teacher differentiates literacy instruction to recognize individual needs.

27. Connection
    - The teacher makes connections between class or community literacy-related knowledge for individuals or groups.
THE CLOS-R MANUAL

DIMENSION 1: RESPECT

1. Rapport

The teacher creates a warm, positive and inviting classroom where relationships with children encourage literacy learning

- Mutual respect and trust between the children and the teacher is clearly evident throughout the teaching and learning e.g., in body language, in dialogue.
- The teacher demonstrates enjoyment of literacy, and of the children, and encourages and accepts all students’ contributions during activities.
- Teacher interventions are tactful and supportive, and aim for improvement in a particular literacy skill or conceptual understanding.
- The teacher encourages children to take risks with their learning, and children appear confident and supported to do so.
- The teacher articulates her expectation of the children’s abilities and capabilities.
- The teacher frequently praises and encourages children in their acquisition of specific literacy concepts and skills.
- Children participate readily, and there is energy, excitement and enjoyment around the literacy learning tasks.

2. Credibility

Children’s respect for the teacher enables her to maintain order and lesson flow

- The teacher establishes and reinforces firm rules for classroom behaviour.
- The teacher provides positive reinforcement of appropriate learning behaviours.
- Disruptions to the literacy lesson are minimal - the teacher either anticipates and prevents disturbance from occurring, or quickly responds to and resolves any potential disrupting behaviour.
- Children respond quickly to teacher's directions.

3. Citizenship

The teacher promotes equality, tolerance, inclusively and awareness of the needs of others

- The teacher places strong and explicit emphasis on fostering a range of values in the classroom.
- The teacher constantly reinforces consideration of others’ learning needs and styles in acquiring understanding of newly taught literacy concepts and skills.
- The teacher often names appropriate behaviour for particular classroom literacy related activities, e.g., listening for specific sounds, looking at the book.
- Children acknowledge, encourage and support successful literacy learning by others.

DIMENSION 2: KNOWLEDGE

4. Purpose

Children’s responses indicate tacit or explicit understanding of the purpose of the literacy task

- The teacher gives very explicit, clear instructions that leave no room for doubt about what is expected as engagement in and outcome/s of the task, and checks children’s understanding before allowing them to begin a literacy task.
- The teacher uses a variety of teaching practices and strategies to describe the literacy task (e.g. questioning…) and consistently reinforces the purpose of a literacy task throughout the activity.
- The teacher provides students with a metacognitive explanation and reason for doing a particular task (e.g., “We are reading this book to understand why…”).
- The teacher constantly checks that children have understood each step, and corrects or offers additional explanations to ensure children’s understanding before proceeding.
- The teacher structures and delivers the content of the literacy lessons in a timely, logical and efficient way.
- Children demonstrate their understanding of the purpose of the literacy task by being able to articulate what the teacher wants them to do.
- Children’s oral or written responses show an understanding of the requirements of the literacy task.

5. Substance

The teacher provides a lesson/task that leads to substantial literacy engagement, not busy-work

- Literacy discussion and tasks/activities provided by the teacher are of a high quality, and go beyond simple routines to require higher levels of conceptual thinking.
- Activities are highly productive and provide for significant learning or consolidation of literacy concepts, appropriate to the level of the children.
- The teacher links or integrates literacy concepts into other learning areas.

6. Explanation word

The teacher clearly explains specific word, letter or sound strategies or concepts

- The teacher explains specific word, letter or sound strategies and concepts at an appropriate level for the children.
- The teacher integrates and teaches concepts of
phonological/phonemic awareness in a variety of contexts.

• The teacher clearly explains the difference between letter sounds and letter names.
• The teacher consistently models and/or uses the terms ‘sound’ and ‘letter’ appropriately
• The teacher clearly explains or reinforces word reading and writing strategies e.g., sounding out, re-reading, making sense within the text, using the context.
• The teacher provides opportunities for children to practise and extend their sight word bank.
• The teacher models and provides opportunities for children to practise handwriting and letter formation skills
• Children demonstrate understanding of word level concepts they have been taught.
• Decoding and graphophonic concepts taught are appropriate to the level of the children, and include: alphabetical order, rhyme, onset, sounds (beginning, middle, end), vowels, word, letter, sound, blend, ‘magic/fairy/bossy’ E, spelling, syllables.

7. Explanation sentence
The teacher clearly explains specific grammatical strategies or concepts

• The teacher integrates and teaches sentence level concepts in a variety of contexts and ways e.g., consistent and repeated modelling.
• Children demonstrate understanding of sentence level concepts they have been taught.
• Grammatical concepts are taught at an appropriate level for the children.
• Syntax concepts taught include: capital letters, full stops, sentence, talking/speech marks, inverted commas, apostrophes, noun, verb, adjective/describing words, contractions, compound words, word order, question marks, exclamation marks.

8. Explanation text
The teacher clearly explains specific textual strategies or concepts

• The teacher uses a variety of texts such as pictures, day charts/calendars, video, postcards, newspapers, narrative, fiction and nonfiction.
• The teacher engages children in pre-reading discussion of the text to predict likely plot, characterization and setting.
• The teacher engages Pre-primary children in emergent reading and writing activities, e.g., describing pictures, locating letters, finding words in a written text
• The teacher guides children in discussion or activities to develop their comprehension of a text.
• The teacher guides children in a discussion of theme after reading a fiction text.
• The teacher guides children in a discussion about factual information gleaned from a nonfiction text.
• The teacher guides children in the presentation of their writing (layout, spacing, selection of information, labelling etc).
• Children identify reading strategies they have been taught (e.g., read from left to right………).
• Children demonstrate understanding of text-level concepts they have been taught.
• Children make use of text-level concepts in their own writing.
• Textual strategies and concepts are taught at an appropriate level for the children.
• Text level concepts taught include: predict, picture, title, author, illustrator, cover, caption, sign, ISBN, copyright, web address, label, paragraph, planning, drafting, revising/editing, story, text type (narrative/story, recount, report, diary, letters, poem, recipe, nursery rhymes), headings, structure (beginning, middle, end), character, setting, alliteration, ingredients, list, fiction, nonfiction, information, layout, address, salutation, meaning (including word definitions), dictionary, alphabetical order.
• The teacher discusses the meaning of vocabulary within a text.

9. Metalinguage
The teacher provides children with language for talking about and exemplifying literacy concepts

• The teacher directs children’s attention to features of words and texts through the use of specific metalinguistic vocabulary.
• The teacher uses metalinguistic terms accurately and consistently and provides clear metacognitive explanations within appropriate contexts and at an appropriate level.
• Children demonstrate understanding of a concept and its application.
• Children identify and use correctly metalinguistic terms and concepts that have been taught.
• Children explain metalinguistic concepts in their own words.
• Metalinguistic terms include: letter names, letter sounds, title, author, illustrator, visualisation, ‘sound it out’, research, bullets, labels, capital letters, full stops, sentence, talking/speech marks, inverted commas, apostrophes, noun, verb, adjective/describing words, contractions, compound words, word order, question marks, exclamation marks.

10. Oral language
The teacher focuses on the development of children’s oral language

• The teacher provides opportunities for receptive and expressive oral language that may focus on development of phonological awareness, vocabulary, sentence structure,
prosody, pragmatics.

- The teacher provides opportunities to develop children’s comprehension and vocabulary.
- The teacher engages children in discussions which extend oral language concepts of speaking and listening - their ability to express themselves, and their level of understanding.
- The teacher interacts with and questions the children in ways which develop oral language.
- The teacher engages children in songs and rhymes that have a strong literacy base e.g., alliteration, rhyming words.

Note: Oral language may be implicit or explicit, and must have the potential to contribute to the children’s language and/or literacy development.

11. Oral/written language

The teacher makes logical connections between oral and written language

- The teacher relates phonological awareness to alphabet letters.
- The teacher links oral discussion of a text with the reading of it (can be before, during or after the reading).
- Oral discussion points are recorded in an appropriate written form.
- The teacher encourages dramatisation or visualisation of read text.
- The teacher makes connections between environmental print in the classroom in conversation with the children.
- The teacher makes use of songs to link oral and written language.
- Children recognise differences between written letters, words and numbers.
- The teacher models writing as she articulates the words.
- The teacher reads aloud from a Big Book, pointing to the words.

DIMENSION 3: ORCHESTRATION

12. Awareness

The teacher has a high level of awareness of literacy activities and participation by children

- The teacher monitors and evaluates children’s participation and progress during activities, and responds accordingly to ensure that as many children as possible are engaged in meaningful learning activity for most of the class time e.g., progressing an activity in response to the children’s understanding, reviewing a concept in response to children’s needs.
- The teacher monitors, responds to, corrects and supervises individuals and groups constantly, and remains aware of each child’s individual progress in the activity.
- The teacher maintains firm control over keeping all children on task, whether working with an individual, a group or the whole class.
- Children are rarely observed off-task.

13. Environment

The teacher uses the literate physical environment as a resource

- The teacher has a wide variety of print and other literacy related resources in and on display around the classroom and uses them regularly.
- The teacher uses charts and other props as part of a routine activity, which involves literacy learning, e.g., weather, days of the week, months of the year, vocabulary.
- The teacher frequently encourages children to refer to the literacy environment to solve literacy problems (e.g., “Go and find that word on our daily word chart.” Directs children’s attention to focus words on the THRASS chart).
- The teacher modifies the environment from time to time to suit different needs or topics e.g., providing an area for theme exploration with books, posters, models.
- Children are observed using the literacy environment independently.

14. Structure

The teacher manages a predictable environment in which children understand consistent literacy routines

- The teacher uses routine attention-directing strategies to which the children respond quickly (e.g., clapping hands, use of props, verbal commands, physical commands…).
- The teacher uses structured ways for rewarding appropriate learning behaviour (e.g., ticks on the board, behaviour charts, verbal cues, physical cues, eye contact…).
- The teacher is consistent in the ways in which she reminds students of established routines for literacy practices (e.g., decoding words, spelling, handwriting, drafting, mechanics of writing…).
- The sequence of activities flows logically from one to another and may be linked to previous learning or to subsequent activities.
- The teacher structures group or individual literacy activities so that children understand the task, understand what constitutes task completion, and understand the sequence of tasks i.e., what to do next.
- Children understand what is expected of them in literacy routines and understand the structure and time frame of given tasks.
- Children’s responses show their familiarity with classroom structures by quickly commencing set routines that the teacher has established (e.g., regular routines for participating in activities such as shared book, modelled writing, moving into small group tasks quickly and getting started immediately).
• Children know where to get regular equipment (e.g., pencils, paper) as well as additional resources and learning aids from around the classroom (e.g., dictionary cards or wall charts) to assist their literacy learning.

15. Independence
Children take some responsibility for their own literacy learning

• The teacher encourages children to regulate their progress in literacy learning by drawing the children’s attention to the learning processes in which they are engaging as well as the literacy content.
• The teacher encourages children to proof-read and edit their own writing.
• The teacher actively encourages children to reflect on and evaluate the quality of their own work and to articulate key learning points.
• Children can work without teacher supervision in small groups, completing the task as instructed.
• Children share their knowledge independently of the teacher in a literacy task.
• Children choose to engage in purposeful literacy activities independent of the teacher-directed program.
• The teacher provides children with strategies or opportunities to work independently.

16. Pace
The teacher provides strong forward momentum in literacy lessons

• The teacher’s clear and efficient instructions ensure that children are focused on the literacy task.
• The teacher’s carefully structured pace is responsive to the needs of all children.
• The teacher sequences lessons at an appropriate pace, utilizing time efficiently.
• The teacher is constantly encouraging, motivating, correcting, directing, monitoring and inspiring the children to master another skill, finish off something, or begin something new.
• The teacher’s organization of the class equipment facilitates efficient use of time for both children and teacher.
• Children respond to questions and activities, and the teacher keeps encouraging them to contribute.

17. Transition
The teacher spends minimal time changing activities or uses this time productively

• Transitions demonstrate efficient use of time, where the teacher ensures that minimum time is wasted on non-learning activities.
• Transition times are used to practise and consolidate literacy learning.
• The teacher use a range of transition strategies e.g., specific cues, props to signal the end of activities, preparing cross-over tasks, staggering the movement of different groups of students and managing to oversee the effective and efficient movement of all groups simultaneously.
• The teacher gives clear and precise instructions to organise the movement of children into the next activity, and encourages children to see time as a valuable commodity in their learning.
• The teacher organises efficient collection and distribution of resources so that minimal time is wasted between tasks.
• The teacher spends minimal time gaining or regaining order after movement from one activity to the next.
• Individual or small group transitions occur where children are working in groups or independently, and move efficiently from one literacy task to another upon completion of the task.
• Children clearly understand and respond to transition strategies.

18. Attention
The teacher ensures that children are focused on the literacy task

• The teacher applies various strategies as required to gain and maintain the children’s attention.
• The teacher keeps all children focused on the learning task using a variety of classroom management strategies e.g., by tactfully naming; asking questions.
• The teacher requires a posture that maximizes attention e.g., eyes this way, sitting up straight, legs crossed, hands in laps.
• Teacher’s explanations and instructions are timed to suit the concentration span of the children so children remain attentive and engaged throughout the explanation.
• The teacher frequently draws children’s attention to key concepts in a task, offering additional information.
• The teacher seeks contributions from all individuals.
• The teacher creates an atmosphere of a ‘conspiracy of learning’ e.g., I’m going to trick you; I bet you can’t…
• Almost all children are attending to and engaged with the literacy task.

19. Stimulation
The teacher motivates interest in literacy through the creation of a pleasurable, enthusiastic and energetic classroom

• The teacher uses a variety of learning strategies, e.g., movement, music, manipulation, listening, observation, use of technology.
• The teacher makes positive, meaningful comments in order to encourage participation in the literacy task.
• The teacher encourages children to share success in literacy learning with others.
• The teacher encourages individuals or groups to strive for high standards.
• The teacher uses questions strategically to create and sustain interest in the topic/task.
• The teacher provides tasks and activities which are interesting and which contribute to literacy learning.
• The teacher models enthusiasm for and enjoyment of literacy learning which results in a classroom atmosphere of mutual excitement for literacy learning.

**DIMENSION 4: SUPPORT**

**20. Assessment**

_The teacher uses fine-grained knowledge of children’s literacy performance in planning and teaching_

• The teacher’s responses to children indicate awareness of individual progress.
• The teacher’s careful observation of children leads to specific literacy teaching.
• The teacher makes judgements about what to teach next based on her assessment of the children’s needs.
• The teacher provides additional support or challenge at the point of need e.g., modelling, metacognitive explanations, requesting more detail or greater quantity.
• The teacher’s clear and specific instructions reduce the need for individualised teaching, and instructions or teaching points are reiterated to the whole class if many children are observed to have the same need.

**21. Scaffolding**

_The teacher extends literacy learning through reinforcement, modification or modelling_

• The teacher provides a very clear initial introduction to the task (instructions, modelling, checking for understanding) which reduces the need for individual support.
• The teacher affirms correct responses and corrects or makes a brief teaching point of incorrect responses, which lead to continued engagement in the literacy task.
• The teacher adjusts and adapts instructions and responses according to the needs of the children.
• The teacher’s interventions lead to children modifying their understanding and performance of literacy tasks.
• The teacher models or re-models literacy concepts and skills which include metacognitive explanations where appropriate.
• The teacher’s use of voice emphasises teaching points or important concepts.
• The teacher breaks a complex literacy task or concept into smaller parts or steps and clearly explains each critical part, providing sufficient time for children to comprehend and practice each step before moving on to the next part.

**22. Feedback**

_The teacher intervenes in timely, focused, tactful and explicit ways that support children’s literacy learning_

• The teacher’s comments to children lead to improvement in the children’s understanding and knowledge of literacy.
• The teacher is constantly encouraging, motivating, correcting, directing, monitoring and inspiring the children to master another skill, finish off something, or begin something new.
• The teacher quickly adapts the cues, amount of participation or the use of reinforcement to the child’s particular needs.
• The teacher reacts to students’ responses through acceptance of correct responses, follow up of partially correct responses and use of student responses in making teaching points.
• The teacher uses positive reinforcement to show acceptance of correct responses and explanations that focus on specific aspects of literacy learning, e.g., Fantastic I like the way you sounded out that word.

*Note - Feedback is secondary to clear instruction or explanation about the task or concept.*

**23. Responsiveness**

_The teacher is flexible in sharing and building on children’s literacy contributions_

• The teacher shares and builds on children’s literacy contributions, making the child’s contribution a teaching point, where appropriate for children’s immediate needs.
• The teacher spontaneously makes a specific learning point that she finds for one child (e.g., the spelling of climbed) into a whole class learning opportunity.
• The teacher demonstrates sophisticated judgment in knowing when to let a class discussion take a tangent and when to keep it flowing along the planned line.
• The teacher responds to the opportunity (planned or unplanned) to model and reinforce concepts learned previously by making the link from past learning to the current lesson.

*Note - Responsiveness is also characterised in some instances by its absence. It is sometimes not appropriate to spontaneously follow a potential diversion to a lesson plan no matter how tempting.*

**24. Persistence**

_The teacher provides many opportunities to practise and master new literacy learning_

• The teacher provides significant amounts of time and opportunity for practising new literacy skills and concepts and then in applying the new skills in different contexts.
• The teacher ensures that children complete literacy tasks to a particular standard.
• The teacher displays drive for improved literacy outcomes and passion for improving children’s understanding and skills.
• The teacher reinforces a particular literacy concept multiple times, and in different ways.

*Note - Persistence will often occur across episodes*
25. Challenge

The teacher extends and promotes higher levels of thinking in literacy learning

- The teacher plans demanding tasks based on knowledge of children's levels of attainment.
- The teacher encourages higher levels of thinking through the use of higher order questioning, usually open-ended, that encourage the exploration of ideas or multiple solutions, rather than simply providing a 'correct' answer.
- The teacher encourages children to explore multiple interpretations of text and respond at higher levels of abstract and critical thinking.
- The teacher provides cognitively challenging interactions.
- The teacher provides higher level explanations that extend the task for children who have understood the concept ahead of other children.
- The teacher uses and encourages children to use a wide, or high level specific vocabulary, e.g., 'exoskeleton' for shell of an insect, use of terminology such as 'alliteration'.
- The teacher provides sufficient challenge for both higher and lower achieving children.
- The teacher scaffolds children's learning through careful sequencing and analysis of tasks to help them achieve deeper understanding.
- The teacher provides learning opportunities for children to synthesise, generalise or transfer concepts.
- The teacher has high expectations of children's achievement and children aspire to achieve the learning goals set by the teacher.
- The teacher builds on unpredictable responses in ways which further challenge children's thinking.
- The teacher encourages children to self-regulate their progress in their literacy learning by drawing the children's attention to the learning processes in which they are engaging, as well as the literacy content.
- The teacher provides children with opportunities to take responsibility for their learning, reinforcing children's belief in themselves as learners and enhancing their sense of confidence.
- The teacher provides opportunities for children to reflect on and evaluate the quality of their own work.
- The teacher's intervention encourages children to take risks with their learning so that she can 'stretch' individual children's capacity to succeed in challenging literacy tasks.

26. Inclusion

The teacher differentiates literacy instruction to recognise individual needs

- The teacher structures literacy activities so that opportunity is provided to work effectively 1-to-1 with individual students or in small groups, where specific support on an aspect of literacy learning is required.
- The teacher monitors the progress of individuals during literacy tasks, and provides specific and targeted support or feedback at point of need or error for each child.
- The teacher adapts general feedback to suit the specific learning needs of each child as she checks children's understanding of literacy concepts.
- The teacher adjusts groupings and explicitness of instruction during literacy tasks according to individual needs.
- The teacher presents opportunities for children to pursue tasks at their own level and provides individual feedback during whole class literacy activities.
- The teacher includes all children in subtle ways in literacy tasks while still catering for individual needs.
- The teacher provides additional learning supports or modified learning materials that have been adapted for children with specific learning needs, which enable them to participate effectively in the whole class literacy task.
- The teacher provides many open-ended tasks to ensure that all children can participate at their own level.
- Children participate in peer-support activities whereby a more able child supports a less able child.

27. Connection

The teacher makes connections between class or community literacy-related knowledge for individuals or groups

- The teacher encourages children to use prior knowledge or to refer to previous learning to assist in a new situation (e.g., remember 'ea' in 'leaf' to read 'eating'; it's the 'ou' sound as in 'house').
- The teacher explicitly connects current and previously learned literacy concepts in new contexts and activities
- The teacher draws on previous learning opportunities, e.g., excursions, to contextualise and connect literacy learning activities.
- The teacher uses knowledge of children's experiences to contextualise, to scaffold and to make links to literacy learning within and across tasks.
- The teacher includes additional literacy tasks, such as shared writing at home with the family, which connects the classroom learning to home life.
## APPENDIX 4

### TABLE A5.1

ToMOS dimensions and item

<table>
<thead>
<tr>
<th>Communicates expectations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentions</td>
<td>The teacher states the mathematics learning intended in the lesson.</td>
</tr>
<tr>
<td>Quality</td>
<td>The teacher states criteria for quality work.</td>
</tr>
<tr>
<td>Responsibility</td>
<td>The teacher encourages student responsibility for learning mathematics.</td>
</tr>
<tr>
<td>Respect</td>
<td>The teacher responds with respect to mathematical questions and comments initiated by students.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Focuses on conceptual understanding</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphasises Meaning</td>
<td>The teacher helps students interpret the meaning of solutions.</td>
</tr>
<tr>
<td>Multiple Solution Methods</td>
<td>The teacher draws focus to more than one solution method.</td>
</tr>
<tr>
<td>Summary</td>
<td>The teacher makes links to generalised cases.</td>
</tr>
<tr>
<td>Misconceptions</td>
<td>The teacher addresses common misconceptions.</td>
</tr>
<tr>
<td>Mathematical Language</td>
<td>The teacher clarifies key mathematical language.</td>
</tr>
<tr>
<td>Multiple Representations</td>
<td>The teacher uses alternative ways to represent mathematical ideas.</td>
</tr>
</tbody>
</table>

| Students are on-task               | Students appear to be doing the mathematical work intended. |

### Episodes for analysis: public interaction

**Definition:** Times in the lesson when the teacher and students engage in public, rather than private, interaction

Public interaction segments may take the form of:
- The teacher providing an explanation, demonstration, or instructions, with students listening.
- A class discussion where teacher and students actively participate.
- Students’ sharing ideas, solution methods, and processes with the teacher and class, etc.

To qualify for a shift between interaction types, a new interaction must last for at least one minute.

Segments of public interaction time will be marked with in- and out-points on the Data Collection Record for each lesson observed.

ToMOS Dimensions 1, 2, & 3 will be applied only to those segments of the lesson that are identified as public interaction segments.

Each of the items in Dimensions 1 and 2 will be marked as occurrences. In-points will be recorded to enable transcript data retrieval for analysis and reporting purposes.

### ToMOS CODING MANUAL

#### DIMENSION 1: COMMUNICATES EXPECTATIONS

**1.1 Intentions (INTE)**

**Definition:** The teacher makes verbal or written statements about the specific mathematics learning intended in the lesson

The learning intentions may relate to:
- ‘Big’ mathematics ideas (for example, key ideas at the strand level).
- Particular mathematics concepts.
- Tasks and assignments.

The intentions will typically be presented in the form of goal statements prior to engaging in some mathematical work.

**1.2 Quality (QUAL)**

**Definition:** The teacher communicates in verbal or written form explicit criteria for quality responses to tasks assigned. The teacher may also explicitly distinguish levels of performance

Criteria presented by the teacher may relate to:
- Mathematical accuracy.
- Mathematical ingenuity.
- Communication/presentation of ideas.

Levels of performance might include:
- Rubric descriptions.
- Numeric/alphabetic grades.
1.3 Responsibility (RESP)

Definition: The teacher makes statements that encourage student responsibility for learning mathematics

The kinds of student responsibilities that teachers might encourage include:

- Asking questions to seek clarification.
- Asking questions to inquire about, or suggest, new ideas or possibilities.
- Focusing or concentrating on their mathematical work.
- Allocating appropriate time for independent studies associated with their mathematical learning.
- Checking and justifying solutions and solution methods.
- Self and peer assessment.

1.4 Respect (REPT)

Definition: The teacher responds with respect to mathematical questions and comments initiated by students

The kinds of teacher responses that indicate respect include:

- Addressing with the class a response to a student’s mathematical question or idea.
- Redirecting a student’s mathematical question or idea to the class, e.g. “What do the rest of you think about that?”.

DIMENSION 2: FOCUSES ON CONCEPTUAL UNDERSTANDING

Items 2.1 – 2.3 refer to worked examples. A worked example is a mathematical task worked on during the current lesson.

2.1 Emphasises meaning (EMEA)

Definition: The teacher helps students to interpret the meaning of solutions to worked examples

This means that either:

- The solution is explicitly linked to the original question.
- The solution is interpreted contextually.

2.2 Multiple solution methods (MSOL)

Definition: The teacher draws focus to more than one solution method for a worked example

The multiple solution methods will either:

- Be presented by the teacher.
- Be presented by students with acknowledgment by the teacher.

2.3 Summary (SUMM)

Definition: The teacher provides a summary statement that clearly links the worked example(s) to a more generalised case

The summary statement will include information about either:

- A strategy for solving similar examples.
- The key features of these general mathematical ideas.

2.4 Misconceptions (MISC)

Definition: The teacher intentionally addresses common student misconceptions by requiring students to analyse examples, solutions, or ideas

The kinds of questions that might indicate the teacher’s intention to address a misconception include:

- Why wouldn’t this work?
- Why isn’t this correct?
- Could this be correct? Why/why not?

2.5 Mathematical language (MLAN)

Definition: The teacher clarifies key mathematical terms and symbols to promote student understanding of mathematical language

Teacher clarification will take the form of either:

- The introduction of new key terms and symbols.
- The refinement of existing key language through questioning, rephrasing, or additional explanation.

The teacher’s verbal or written description of the key mathematical term or symbol will be followed by either:

- A question to students that probes their understanding of the term or symbol.
- A question to students that requires an application of the term or symbol.
- An elaborated example of how the term is used in a particular context.

2.6 Multiple representations (MREP)

Definition: The teacher uses alternative ways to represent mathematical ideas

For an episode to be coded Multiple Representations (MREP), the teacher would use two or more of the following at any point in the episode:

- Written symbols, formulae, or descriptive examples.
- Graphs and tables.
- Drawings or diagrams.
- Physical materials.

Graphs, tables, drawings and diagrams may be part of a problem statement, used in a solution process, or used in a discussion of a mathematical idea or concept. Physical materials may be used to demonstrate a solution process or in a discussion of a mathematical idea or concept.

A table is an arrangement of numbers, signs, or words that exhibits a set of facts or relations in a definite, compact, and comprehensive form. Typically the rows and/or columns of a table are labelled and have borders.

To count as a drawing or diagram, the drawing must include information relevant to doing the mathematics. It does not count as a drawing if the symbols are spatially arranged to...
highlight certain features, if arrows are pointing to certain symbols to highlight them, or if arrows or other nonstandard marks are used in place of standard symbols (e.g. an arrow is used instead of an equal sign).

Physical materials include:
- Measuring instruments (e.g. ruler, protractor, compass).
- Special mathematical materials (e.g. tiles, tangrams, base-ten blocks).
- Geometric solids.
- Cut-out plane figures (e.g. triangles and trapeziums cut from paper).

Papers, pencils, calculators and computers are not included here.

Notes -
- The use of measuring instruments for non-measurement purposes, such as underlining or drawing straight lines with a ruler, or drawing a circle of unspecified measure with a compass, does not count. If it is unclear whether or not measuring instruments are being used to measure, assume they are not.
- Using graph paper to plot points on the coordinate plane does not count, but using graph paper to measure the surface area of an object, or to find shapes with a common area of 12 square cm does. That is, using graph paper as a measuring tool counts as a use of physical materials.

**DIMENSION 3: STUDENTS ARE ON-TASK**

3.1 On-task (ONTA)

Definition: Students appear to be doing the mathematical work intended by the teacher

For an episode to be coded On-Task (ONTA), less than 25% of students would be observably not on-task at any point in the episode.

Additional notes are to be recorded on the Data Collection Record for each lesson observed.

Notes -
These notes may relate to:
- The mathematical content of the lesson
- Materials and resources used
- Images presented on a blackboard, whiteboard, or OHP
- Student groupings
- Any event that is unusual, surprising, striking, etc.
- Any information that may be helpful to understand particular circumstances of the lesson observed
- etc.
### APPENDIX 5

#### TABLE A6.1

ToMOS record sheet

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>Class ID</th>
<th>Date</th>
<th>Time</th>
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<tbody>
<tr>
<td>Mathematics strand</td>
<td>Mathematics topic</td>
<td>Sequence of lesson in unit</td>
<td>Notes</td>
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