NAPLAN

2015 State report: Year 3

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Preface

The purpose of the National Assessment Program is to collect information that governments, education authorities and schools can use to determine whether Australian students are reaching important educational goals. As part of that program, the Literacy and Numeracy tests are valuable sources of information about literacy and numeracy learning that can be used to inform educational policy and current educational practice.

The National Assessment Program — Literacy and Numeracy (NAPLAN) tests are developed using the nationally agreed *Statements of Learning for English* and *Statements of Learning for Mathematics, 2005*. These statements describe essential skills, knowledge, understandings and capabilities that all young Australians should have had the opportunity to acquire by the end of Years 3, 5, 7 and 9. From 2016, the tests will relate to the Australian Curriculum.

The NAPLAN tests are designed to provide a nationally comparable indication of student performance in Language conventions, Writing, Reading and Numeracy. The tests are designed to assess a student's ability to demonstrate the following skills:

- **Language conventions:** The test assesses the ability of students to independently recognise and use correct Standard Australian English grammar, punctuation and spelling in written contexts.

- **Writing:** The test assesses the ability of students to convey thoughts, ideas and information through the independent construction of a written text in Standard Australian English.

- **Reading:** The test assesses the ability of students to independently make meaning from written Standard Australian English texts, including those with some visual elements.

- **Numeracy:** The test assesses students' knowledge of mathematics, their ability to apply that knowledge in context independently, and their ability to independently reason mathematically.

This document reports the performance of Queensland students in Year 3 who sat the 2015 National Assessment Program — Literacy and Numeracy (NAPLAN) tests.

Who should use this report?

NAPLAN: State report will help teachers, principals and other school personnel understand, interpret and use the student performance information contained in the test reports. Class and school reports are supplied electronically on the secure section of the Queensland Curriculum and Assessment Authority (QCAA) website: https://naplan.qcaa.qld.edu.au/naplan/pages/login.jsp. These reports are accessible only with the school's Brief Identification Code (BIC) login and password. Individual student reports are distributed to schools as printed copies.

Principals

Principals can use this document to help interpret their school reports and to provide information to the school community on aspects of the tests. The document provides information on how to access and interpret the online reports located on the QCAA's website.

Curriculum leaders, Heads of Department and Heads of Special Education Services

Queensland's performance on each of the Literacy and Numeracy strands is provided in this document. Curriculum leaders can use this information to interpret the class reports.

Classroom teachers

Classroom teachers can use information such as the item descriptors, state and national results and the commentaries provided in this report to interpret their class reports. Teachers can compare the performance of their students on a particular item with Australian results. For example, an item with a low facility rate may not necessarily indicate a problem in teaching and learning. It may be that this was simply a difficult item for all students in this cohort across Australia. The results for such an item may provide information about the learning challenges associated with that concept but should not necessarily be cause for concern.

Parents/carers

Parents can use the information in this document to interpret the results on their child's report. They are also able to judge how their child performed when compared with the whole population of students. The item descriptors provide useful information about the scope of the tests.

Pre-service teachers

Pre-service teachers will find the information in the commentaries on overall student performance useful in gaining an understanding of what students know and can do in some areas of Literacy and Numeracy at Year 3.

Placing the tests in the assessment context

The NAPLAN tests are national instruments designed to contribute to a school's assessment program and to inform the teaching and learning cycle. It must be remembered, however, that the results from the 2015 NAPLAN tests represent only one aspect of a school's assessment program.

The results from a school's formal and informal assessment of students should be consistent with the NAPLAN test results. Principals and teachers should keep in mind that these were pencil-and-paper, point-in-time, timed tests. If the test results are different from what was expected, consider the possible reasons. The results of the tests may indicate aspects of student performance that need further investigation within the classroom using other forms of assessment.

Marking and scoring the tests

Marking the tests

The tests are scored against nationally agreed marking guides. There are four guides, one for the writing task and one each for the open responses in reading, numeracy and spelling. These guides provide information on the acceptable forms of the correct answer.

For the Numeracy tests, students may provide a correct response in different forms. Professional officers review these results and decide how to score.

Calculating raw scores

The simplest calculation made in scoring the tests is the raw score — the number of questions answered correctly. All of the questions for the Language conventions, Writing, Reading and Numeracy tests are marked as either correct or incorrect.

Constructing scale scores

Raw scores have limited use. They enable the performance of students who have all completed

the same test at the same time to be placed in a rank order, but they do not provide information about the level of difficulty of the test nor the relative differences between students.

To achieve this, raw scores are transferred to a common scale that reflects how difficult it was to achieve each score. The scale is comparable between year levels for each assessment area. An equating process is also carried out on each year's test to enable scores to be compared between years of testing. This might mean, for example, that a raw score of 20 on the Year 3 Reading test is transformed to a scale score of 354. This will also represent the same achievement for a student with the same scale score in Year 5, and for a student with the same scale score for Reading in a previous year.

The single scale for all students in all year levels is centred on approximately 500. Scale scores also provide a basis for measuring and comparing students' abilities across years of schooling, for example comparing a student's result in Year 3 in 2013 and Year 5 in 2015.

Using scale scores

The scale score can be used to compare the results of different students. Principals and teachers should take care when making comparisons between small groups of students. For groups of fewer than 10 students, differences may not be reliable, particularly small differences.

The scales can be used to monitor the growth of groups of students over time. Principals and teachers should ensure that the compositions of the groups are the same. This enables the school to evaluate special programs that may have been put in place.

Understanding the data

Which reports?

The *NAPLAN National Summary Report* and the NAPLAN *National report* provide nationally comparable data about student performance within the National Assessment Program. These data provide states and territories with information about the achievement of their students in relation to their peers across the nation. These data are available from the ACARA website.

This *NAPLAN State report* provides detailed information about student performance on each of the test items. It gives information about:

- the Queensland performance on each of the items
- the national performance on each item
- the item descriptors
- some commentary on the state results
- some recommendations for teaching.

Together, these publications provide system-level information and are generally available.

NAPLAN data	National report	Government systems Australian public	Analysis of systems data: • Systems planning • Trends
	School report	Schools	Analysis of school data: • Range • Comparisons of student & state

	Class report	Teachers	Analysis of class data:
			• Test results by
			  – class
			  – group response

			Teaching, learning and assessment including planned explicit teaching and feedback based on identified learning goals.

The NAPLAN *School reports* give information about a school's performance in each year level tested. They provide a summary of year-level performance as well as performance by gender, language background and Indigenous status in the following fields:

- distribution of scale scores
- distribution of achievement bands
- school and state means
- participation of the group.

The shading showing the range of performance for the middle 60% of Queensland students, together with the state mean, locates a school's performance relative to that of the state.

The NAPLAN *Class reports* show the performance of each student on every item. They show the items a student had correct, including the errors made in each strand with the exception of reading, where the answers are generally too long to record.

The report also gives the:

- scale scores for each student
- bands for each student
- percentage correct for each item for the class and state, and by gender.

The NAPLAN school and class reports are available to schools from the QCAA secure website.

Using data to improve teaching and learning

While the national and state reports provide the comparative data, it is the class reports that provide a school with the information that can be used to inform teaching and learning and to build capacity in schools. Analysis of the NAPLAN class data, in particular the performance on each item, will provide teachers with information about the understandings and patterns of misunderstandings in student learning.

An analysis of the distracters presented in multiple-choice items and the answers to the constructed-response items, other than those for reading, is available through the SunLANDA data analysis tool. This is available on the QCAA website and is designed to help schools with their analyses of class and school results. These results should be placed in a context with other school-based assessments.

Looking at the performance on the items and then analysing the error patterns allows teachers and principals to make hypotheses about why groups of students make particular errors. Schools can:

- compare the facility rates (percentage correct) of items to see if their performance is consistent with the national and state results available in this document
- look at the common errors made by their students and compare them with the common errors made in the state
  (Only errors from Queensland students are available. These are found in the item analyses that are part of SunLANDA.)
- form hypotheses about why students are making these errors, e.g.
  - How did students think about this aspect of curriculum?
  - What misunderstandings might these errors represent?
  - How might the structure of the test question have shaped the response?

Using a combination of the NAPLAN data, school data and professional judgment, teachers should then test these hypotheses to see whether they are valid or whether there is more to be thought about and investigated. Interpretation of these results allows teachers to make judgments about teaching approaches and curriculum.

The professional conversations that are part of this process are the most effective and powerful way to use the data as they are the vehicle for developing shared understandings.

Year 3 Writing

Writing prompt

YEAR 3 AND YEAR 5

Try this activity

Choose a sport, hobby or activity that you are interested in. Write to persuade a reader why they should try your chosen activity.

- **Start with an introduction.**
  An introduction lets a reader know what you are going to write about.

- **Write your reasons for your choice.**
  Why is it important for others to get involved in this activity? Explain your reasons.

- **Finish with a conclusion.**
  A conclusion sums up your reasons so that a reader is convinced of your opinion.

Remember to:
- plan your writing
- use paragraphs to organise your ideas
- write in sentences
- choose your words carefully to convince a reader of your opinion
- pay attention to your spelling and punctuation
- check and edit your writing so it is clear.

Key messages

About the task

In 2015, the NAPLAN Writing test used two prompts for the first time, one for Years 3 & 5 and another for Years 7 & 9. Besides this change, the test conditions and administration remained the same as in previous years, i.e. teachers delivered the same spoken instructions and read the text aloud to students. Working independently, students had to plan, compose and edit a written response. Students were allowed five minutes to plan, 30 minutes to write their script, and a further five minutes to edit and complete the task. Three pages were provided for students to write a response.

The 2015 prompt for Years 3 & 5 was entitled *Try this activity*. Students were asked, in the textual component of the prompt, to choose an activity such as a sport, hobby or other activity and write to persuade a reader why they should try that chosen activity. Additional information was provided in the textual component of the prompt. This named the structural components, and further defined these elements, e.g. *Start with an introduction. An introduction lets a reader know what you are going to write about.* Other notes were also provided in relation to the conventions associated with this type of writing task. A series of stylised silhouetted images of various sports and activities surrounded the textual component of the prompt. As was the case in 2013 and 2014, the prompt was relatively open-ended, allowing students to base their writing on a topic of their own choice within the persuasive genre.

Markers for this Writing test were trained using the national persuasive writing marker training package, delivered as part of ACARA's national assessment program. Markers were recruited and trained in accordance with national protocols. Registered teachers mark the NAPLAN Writing test in Queensland. All markers applied the 10 criteria and related standards from the marking rubric. Writing test scripts were marked on screen in all states and territories. Stringent quality-control measures were applied to the marking of student scripts, including a prescribed percentage of scripts to be double-marked, and the daily application nationally of control scripts for all markers. As part of the Queensland marking operation for 2015, referee marking was expanded to further ensure marking reliability. There is also provision for appeal over individual Writing test scores, once test results are released. On appeal, a student's script is re-marked independently by two senior Writing test markers. The NAPLAN Persuasive writing marking guide is available at www.nap.edu.au/NAPLAN/About_each_domain/Writing/index.html.

Performance

As evidenced in scaled scores, there was a marked improvement in the performance of Year 3 students, and to a lesser extent Year 5 students in the 2015 Writing test, compared to 2014 performance. A number of factors may have influenced this result. Anecdotally, teachers reported that younger students felt quite comfortable with the 2015 prompt. Its open-ended nature and its familiar subject/s provided a useful source on which students could base their persuasive writing. The 12 graphics representing different activities may have helped students decide on a suitable topic, though these silhouetted forms tended to be more symbolic or representative of sports, hobbies and the like. Interestingly, there was no trend apparent in students' 'touring the stimulus' as their response, a pattern that had occurred in an earlier NAPLAN Writing test prompt where multiple images were displayed.

For younger students, a more scaffolded approach in teaching and learning can support greater control over the textual and structural features of a persuasive text. Since this was the fifth consecutive year in which this genre formed the basis of the Writing test, it is likely that school programs have become more closely directed to enhancing student control of this genre. There is

a balance though, between adopting a particular text structure on the one hand (e.g. a five-paragraph essay), and developing in students a deeper understanding of how it is that a writer is able to **persuade** a reader. The more that teachers are able to address these broader logical and textual aspects of the genre, such as condition, cause and effect, use of supportive evidence etc., the better the foundation that will be laid for successful students' writing in the future. Embedding these features in persuasive writing also yields a grammatical bonus, so that even young students can explore the use of more complex sentence forms, text connectives, modal operators etc.

Because the prompt asked students *to persuade a reader why they should try a chosen activity*, students generally identified others their age as the likely audience for the text. This allowed for a more natural control of language and vocabulary. In terms of text structure, many students still adopted the *firstly, secondly …* approach for body paragraphs, with introductions that usually included a preview, and conclusions that frequently amounted to little more than re-statements of introductions. Students who were able to foreshadow or précis their arguments in more interesting ways were generally rewarded.

Topics centred around sports, hobbies and games (particularly electronic games). Because students were familiar with these activities, they could draw on specific field knowledge quite readily. Shaping this supporting information into a persuasive form was not always achieved with fluency, and it was not uncommon for writers to just make simple 'persuasive' statements such as … *and this is why you should try this* …. As previously mentioned, the top and tail approach, with an introduction and conclusion 'sandwiching' points of argument, was most common. There appeared to have been some gains in vocabulary choice and use by younger students, though the criteria descriptors emphasise the need for precision, and this requirement was not always adhered to; i.e. students may have experimented with vocabulary that was not always contextually appropriate.

References

Australian Curriculum, Assessment and Reporting Authority, 2013 *Australian Curriculum: English*
www.australiancurriculum.edu.au

Queensland Curriculum and Assessment Authority, 2013 *Hidden worlds*
www.qcaa.qld.edu.au/downloads/p_10/3579_wt_hidden_worlds.pdf

Queensland Curriculum and Assessment Authority, 2011 *Queensland's Literacy Test: A framework for describing spelling items*
www.qcaa.qld.edu.au/downloads/p_10/3579_describing_spell_items.pdf

Writing task sample

Year 3 — You must try Minecraft

You Must try Minecraft

(NP)Minecraft is an educational video-game that everyone must try. You can stratigise by using resources and tools to achive awesome things, trade and farm for better items and be creative by building whatever. Don't you find that amazing?

Firstly,
^in the game of minecraft, you must stratigise to achive things like getting diamonds, every miners goal. This is very tough, because they are extremely rare and you need an iorn pickaxe to mine them. But they are the only way to get to other dimensions, and gather awesome things. Wouldn't you like that thrill?

Secondly, you industrialise to create better things and get more food options. Also, farming cows doesn't just allow you milk, but lets youl get lots of leather for the best enchantments! Trading with villagers needs emeralds, the rarest ore in the game, but you can get items like magical books, glowstone and even enchanted stuff! Food like carrots are good when you've killed all animals close by or you just don't like killing. There's nothing better than not needing to kill!

(NP) Finally, you can be creative and build whatever you want. Make towers, castles and much more! Defend yourself with a base

or make a breatiful garden. There's nothing better!

For all the reasons above, you must give the educational game where you can stratigise, build and trade a try!

Year 3 —You must try Minecraft

Audience	4

The student chooses some writerly words and sentence forms but is still learning how to fill in gaps for an absent audience. He makes the choice to address a specialist audience of fellow gamers. This is a commendable decision, but it should have been signalled so that a general reader understands that the terminology of games may be used without explanation. Calling Minecraft a game which *everyone must try* makes sense if it means 'everyone who likes games'. But even gamers need more explanation than is supplied in paragraphs one and three. The script drifts into statements about **how** to play instead of giving reasons **why** a reader should play. That is, a descriptive purpose interferes with the persuasive purpose.

Text structure	3

The script has two developed components with an undeveloped conclusion. Like so many other scripts, this one gives three unlinked reasons which are then converted to three body paragraphs. Students and teachers should aim beyond this formula. (See ACELA1531 in the Australian Curriculum.)

Ideas	4

The ideas support the claim just well enough to score 4. The writer's authentic attitudes come through (e.g. a preference for creativity over 'killing' games). The student's enthusiasm is engaging, although mere description of game-play is not in itself persuasive. There is an appeal to the principle of creativity.

Persuasive devices	3

Some students try to 'persuade' by using in their scripts the commands they hear from adults and advertisements (e.g. 'You've got to do your chores!; 'Buy it now!'). Although commands are usually ineffective, they are less jarring in this script (e.g. *Make towers, castles and much more!*) because of its tone of speaking to fellow gamers. Personal endorsements (*There's nothing better!*) exclamation marks and rhetorical questions are used with more effect than usual in this script.

Vocabulary	3

The script uses the terminology of Minecraft, e.g. *dimensions, strategise, industrialise, enchantments, villagers, diamonds, emeralds, resources, iron pick axe*. The student selects formal verbs (*achieve, allow, gather, defend*) and nouns (*items, food options*) but also falls back into imprecision (e.g. *whatever, things, stuff, lots*). Adjectives add detail and evaluation (*rarest ore, beautiful garden, educational video game, extremely rare*). Error: an emerald is a gem, not an *ore*.

Cohesion	3

The student is able to keep the topic and subtopics in focus. Notice how grammar helps, e.g. at the end of paragraph three the student moves from *killing animals* to *killing* to *needing to kill.*

Paragraphing	2

Paragraphs keep to the same topic. Some structure is apparent, e.g. in paragraph two, although the student mechanically ends with a rhetorical question. The TEEL checklist (**T**opic sentence, **E**xplain, **E**xample, **L**ink forward and back') is certainly worth teaching, but not as a 'rule'.

Sentence structure	4

The student has a good repertoire of elaborated sentence forms, e.g. *In the game of [M]inecraft* (premodifying prepositional phrase) *you* (subject) *must strategise to achieve* (verb group) *things like getting diamonds* (object) *[that are] every miner's goal* (relative clause). The rambling second sentence nevertheless avoids being ungrammatical. Students should be discouraged from trying to list their '3 reasons' in one sentence. Incorrect: *Trading ... needs (*should be ***requires***); *allow you milk* (should be *allow you **to get** milk)*; *food like carrots are* (should be *food like carrots **is**; **like** (*should be ***such as***).

Punctuation	4

The student controls the basics and is ready to learn better internal punctuation of mature sentences.

Spelling	5

Correct: More than 10 'difficult' words are correct. Incorrect: *beautiful, achieve.*

Year 3 Literacy

Language conventions

Spelling — Results and item descriptions

The percentage columns give the proportion of correct answers (facility rates).
These results are based on provisional data.

Item	Answer	Qld%	Aust%	Description
Proofreading — error not identified				
1	D face (fase)	86.1	87.7	Identifies an error in a word with a soft *c* (*s* sound spelled with the letter *c*).
2	B door (dore)	84.7	86.7	Identifies a mistake in a word with the *r*-controlled vowel *oor*.
Proofreading — error identified				
3	frog (frogg)	96.2	96.5	Correctly spells a word where *g* follows a short vowel pattern CVC.
4	bee (be)	95.1	95.4	Correctly spells the homophone *bee*.
5	spider (spyder)	76.4	79.1	Correctly spells a word with an open first syllable.
6	enjoy (enjoi)	65.2	69.5	Correctly spells a word with the diphthong *oi* spelled *oy* in the final syllable.
7	rocket (roket)	68.1	71.7	Correctly spells a two-syllable word with the digraph *ck* closing the first syllable.
8	edge (edje)	57.6	58.7	Correctly spells a word with the complex consonant blend *dge*.
9	cover (cuver)	45.9	54.1	Correctly spells a word with a neutral vowel (a schwa) in the first syllable.
10	swan (swon)	42.7	50.5	Correctly spells a word where *w* influences the short vowel: *a* for *o*.
11	artist (artest)	33	37.3	Correctly spells a word with the suffix *-ist*.
12	multiply (multaply)	24.2	31.8	Correctly spells a word with the Latin prefix *multi-*.
13	chalk (chork)	14.4	17.7	Correctly spells a word with an *l*-influenced diphthong: *al.*
14	exactly (eksactly)	10.1	13.3	Correctly spells a word with the ambiguous consonant *x*.
Proofreading — error not identified				
15	tray (trey)	63.7	67.6	Identifies a mistake then correctly spells a word with the long *a* vowel *ay*.

Item	Answer	Qld%	Aust%	Description
16	wooden (wouden)	58	61.5	Identifies a mistake then correctly spells a word with the diphthong *oo.*
17	rabbit (rabit)	46.4	54.9	Identifies a mistake then correctly spells a word with the doublet *bb* at the syllable juncture.
18	nailed (naled)	37.5	41.1	Identifies a mistake then correctly spells a word with the long vowel *a ai.*
19	bunches (bunchs)	30.2	33.6	Identifies that the plural inflection *-es* follows a word ending in *ch*.
20	thankful (thankfull)	40.4	43.5	Identifies a mistake then correctly spells a word with the suffix *-ful.*
21	insects (insecks)	21.9	28.6	Identifies a mistake then correctly spells a word with the final consonant pattern *cts* in a base word.
22	nursery (nursry)	21.8	25.9	Identifies a mistake then correctly spells a word with the suffix *-ery* requiring a change to the base word (*e*-drop).
23	stomach (stomack)	10.7	15.3	Identifies a mistake then correctly spells a word with the hard *c* represented by *ch.*
24	squeezed (squeese)	10.7	10.9	Identifies a mistake then correctly spells a word with the consonant *z.*
25	disguised (disgised)	3.8	5.7	Identifies a mistake then correctly spells a word with the hard *g* sound spelled *gu*.

Spelling — Key messages

Performance

In general, Year 3 students should have moved beyond the Letter-name or Alphabetic stage of spelling development and should be working in the within-word stage where they learn how sounds are coded with patterns of letters. They learn that knowledge of the sequence of letters, position in relation to other letters and frequency of letter patterns helps spellers make decisions. During the within-word stage, students begin serious study of the conventions for adding inflectional endings. This challenge should not be underestimated.

The 2015 spelling items had a strong focus on the knowledge of more sophisticated and unusual aspects of vowel patterns such as the spelling of:

• long vowels and diphthongs in two-syllable words as in *spider* and *nailed*

• vowels in unstressed syllables such as in *artist, multiply* and *nursery*

• consonant-influenced vowels such as in *swan* and *nursery.*

Some consonant patterns tested, such as those in *exactly, stomach* and *disguised,* were also challenging. The results suggest that they should be the subject of focused teaching in Year 3 and beyond. Items 22–25 were not attempted by 10% or more of the Year 3 cohort.

The first two items on the 2015 NAPLAN spelling test were multiple-choice questions and the students were required to identify the misspelt word. A large percentage of Queensland Year 3 students were able to do this and their results were consistent with the national result. The first

item, *face*, required students to understand long vowel patterns and the way the vowel pattern interacts with the consonant. For this word, students needed to be aware that the *s* sound was spelt with the letter *c* (a soft *c*). Approximately 86% of students chose the correct option in this item. Item 2 required the students to understand an *r*-controlled vowel, a major subcategory of vowels that will need to be examined closely and reviewed regularly.

Queensland Year 3 students performed very well on the first two error-identified items of the test. A high percentage of students demonstrated an understanding of the short vowel *o* followed by the letter *g*. They knew it was a *CVC word* and only needed one *g*. Item 4 was testing the students' knowledge of homophones and just over 95% of Queensland students spelt it correctly.

Items 9 and 10 tested knowledge of difficult vowel sounds, the neutral vowel (or schwa) in *cover* and the *w*-influenced vowel in *swan*. Queensland students had more difficulty with these items with a result well below the national one. The *l*-influenced diphthong *al* in *chalk* proved to be very difficult for Year 3 students with only 14% being able to correct this word, spelt *chork* in the item.

Four error-unidentified items also tested the coding of vowels. Of these, items 15 and 18 required students to spell words with a long *a* sound, *ay* as in tr*ay* and *ai* as in n*ai*led. Approximately two-thirds of students were able to correct the single-syllable word *trey (tray),* although they found *naled (nailed)* much harder, probably because of the added task of working with the suffix *-ed*. Just over one-third of Queensland students successfully corrected this item.

While nearly 60% of Queensland students were able to correctly spell a complex consonant blend in the error-identified word *edge*, words with complex or ambiguous consonant patterns provided a significant challenge, with only 10% being able to correct *eksactly (exactly)*, *squeesed (squeezed)* and *stomack (stomach).* This pattern of results was seen across the nation with only a very small number of students able to spell these items.

Students' knowledge of open and closed syllables was also tested and Queensland students were reasonably successful on items 5 and 7, where the error was identified and occurred in the stressed syllable. As anticipated, students found identifying and correcting the misspelling of *rabbit* (item 17) more challenging. This is a word with a syllable closed by a doublet at the syllable juncture. Only about half of the Queensland students were successful with this item, a much lower result than the national figure.

Approximately one third of Queensland Year 3 students were able to identify and correctly spell the target word *bunches* (item 19). This was an error-unidentified item and in the majority of the common errors the students incorrectly targeted the word *several.* The difficulty in finding the error may indicate that students need to be taught the proofreading strategy of finding the base word, checking its spelling and checking the spelling of inflectional endings (in this case a plural inflection).

The conventions for adding suffixes to a base word were also tested by items 11, *artest (artist)*, 20, *thankfull (thankful)* and 22, *nursry (nursery)*. The low facility rates on these items is not unexpected but teaching this spelling knowledge can greatly speed its development.

The word *multiply* was more easily spelt if students knew the Latin prefix *multi-* and were able to apply this etymological knowledge. However, the common errors show that students failed to correct the *a* in the middle syllable and instead attempted to spell the word by sound. As *multiply* is a mathematical term well-known to Year 3 students, it provides an opportunity for them to develop their understanding of Latin prefixes and to learn how finding chunks of meaning inside words makes spelling these longer words easier. Year 3 students will have many more opportunities to increase their knowledge of Greek and Latin prefixes and suffixes as they develop their spelling knowledge.

The item with the lowest facility rate was item 25, *disgised (disguised)*, where the students needed to know that the hard *g* was spelt *gu*. Only a small percentage of students across the nation were

able to select and correctly spell the targeted word, indicating that it was beyond the current spelling knowledge of the majority of Year 3 students.

Implications for teaching

Year 3 students need to move beyond the strategy of mapping sounds to single letters. They need to develop problem-solving strategies for learning and monitoring their spelling as well as for use in proofreading. They need an understanding of simple and complex letter/sound relationships, an ability to notice and use patterns in words (how words sound, how they look and their meaning), and an ability to use a range of word-solving strategies.

To spell words with long vowels, students need to learn about the sequencing of the letter patterns, the positions in which they occur and the probability with which they will occur. For example, two items tested students' knowledge of the long *a* sound, *trey (tray)* and *naled (nailed)*. Students needed to know the most common patterns for spelling this sound (i.e. *ay, ai, a-e* and *ei*) and when each pattern should be used. They should know that *ay* is highly likely to occur at the end of a word, such as *tray,* but very unlikely to occur in the middle of a word, where you would commonly use either *ai* as in *nail* and *a-e* as in *bake*.

Year 3 students need to be explicitly taught about the influence of meaning on spelling. It is important that they develop the key understanding that words with similar meaning will maintain that spelling even if the pronunciation changes, and words with different spelling, even if they sound the same, will have a different meaning, as seen in item 4, *be* and *bee*. The knowledge that students develop as they explore homophones is the foundation for understanding how spelling has a meaning layer.

The conventions for adding inflectional endings and other suffixes is a key teaching point. Students need to be taught the conventions for adding plural and tense endings. They will later need to generalise this to the adding of other suffixes. The convention for doubling is also of critical importance as it is the one that will help students understand syllable patterns. An understanding of what makes a syllable open or closed is also an important concept to be taught. Three items on the 2015 Spelling test targeted this concept — *spider, rocket* and *rabbit*.

The ability to apply spelling knowledge to proofreading is a difficult activity for Year 3 students. They must be able to draw on their knowledge about the spelling system in an organised and strategic way. Performance on the error-unidentified items shows how difficult this is. Students need support to develop their proofreading abilities through focused and direct teaching. This knowledge can be built by using learning strategies such as Look-Cover-Write-Check, or the BEE keys, which ask students to observe, remember and use specific word features such as sequence, frequency and position of letters. When using these strategies, students need to be able to articulate what they are looking at, what they are checking for and what strategies they apply to this knowledge. The importance of teaching proofreading strategies should not be underestimated.

Teachers must also continue to work on the test-wiseness of their students. They must know that the circled, identified word is incorrect and they should not reproduce it as the correct answer. This year, for nine of the 12 error-identified words, the supplied misspelling appeared among the five most common errors made by students attempting to spell the words.

Please refer to SunLANDA for a detailed analysis of individual test items, including teaching ideas designed to assist with the development of the understanding and skills required by each item. SunLANDA is available to all schools on the QCAA website.

Grammar and punctuation — Results and item descriptions

The percentage columns give the proportion of correct answers (facility rates). These results are based on provisional data.

Item	Answer	Qld%	Aust%	Description
26	B	89.4	90.7	Identifies the correct preposition to complete a phrase.
27	C	93.8	93.7	Identifies the correct preposition to complete a phrase.
28	A	88.9	89.6	Identifies a word with an adjectival function.
29	B	84.2	84.7	Identifies a word with an adjectival function.
30	A	84.6	85.4	Identifies the superlative form of an adjective.
31	D	73.5	76	Identifies the correct quantifier in context.
32	C	75.9	75.9	Identifies the correct position for a list comma.
33	B	70	70.3	Identifies the correct pronoun referring to a compound subject.
34	B	69.4	70.7	Identifies the sentence requiring a question mark.
35	C	68.1	67.4	Identifies an adverb in a sentence.
36	A	61	59.8	Identifies the correct use of an irregular verb.
37	D	73.8	75	Identifies the correct verb tense in context.
38	A	65	66.2	Identifies the correct punctuation of a list.
39	D	52.9	54.6	Identifies the correct use of an irregular verb.
40	D	59.8	58.3	Identifies the correct use of a possessive pronoun.
41	D	51.4	54.1	Identifies the correct punctuation of direct speech.
42	B	49.3	50.5	Identifies a complete sentence.
43	A	66.2	64.2	Identifies a correctly punctuated contraction.
44	B	59.9	59.6	Identifies a noun.
45	C	50	48	Identifies a command.
46	C	47.7	45.6	Identifies the correct boundary punctuation for a simple sentence.
47	A	47.2	49.2	Identifies the correct boundary punctuation between a complex and a simple sentence.
48	B	34.5	35.9	Identifies the sentence with the correct indefinite article.
49	D	41.8	43.5	Identifies the sentence which combines information in a table.
50	D	20.9	22.8	Identifies a noun which has the same form in the singular and plural.
51	C	25.7	26.3	Identifies the correct punctuation of proper nouns.

Grammar and punctuation — Key messages

There were 26 questions in this part of the test. Seventeen were about grammar and nine about punctuation.

Performance

The performance of Queensland Year 3 students on the grammar and punctuation questions was very similar to that across Australia, with only small variations, both above and below, the national result.

Grammar

The first six grammar questions asked the Year 3 students to select the correct word to complete a sentence. To do this, students needed to select the correct grammatical form from natural language. Most students across Australia were able to do this. The first two grammar questions, (26 and 27) required students to select the correct preposition and approximately 90% of Queensland students had success with these items. These results indicate that the majority of Year 3 students are able to combine prepositions using the grammar of everyday language.

The next three items required students to select the correct adjective to complete the sentence and they demonstrated between 85% and 89% success with these items. Year 3 students need to understand the use of comparative and superlative adjectives and these can be taught as part of their regular spelling and word building activities. They need to know how to identify adjectives and the adjective's function in describing a noun within a sentence.

Item 31 required students to identify the correct quantifier to complete a sentence and approximately three quarters of Queensland Year 3 students were able to do this. In English grammar a quantifier is a word or phrase which indicates the number or amount being referred to, and this item required careful reading by students to ensure their sentence made sense. The sentence referred to a singular *child*, meaning that the quantifier selected needed to match this.

Students always need to read the whole sentence when attempting to work out an unknown word. This reading behaviour needs to be part of all reading activities, as well as being reinforced as a test-wiseness strategy. Being test-wise by rereading their responses is an important strategy to use in items where students have to choose a word to complete a sentence. If they try each of the words in the complete sentence they should be able to 'hear' which word makes sense.

Items 37 and 39 required students to identify the correct verb tense in context. This is a task that may be challenging for students for whom English is a second language. Year 3 students are required to understand that verbs are anchored in time through verb tense and they must be able to construct verb groups to represent past, present and future tense. 73% of Year 3 students selected the correct future tense sentence, while only 52% were correct with the past tense sentence.

Three items (42, 45 and 49) required the students to have sentence level knowledge, and less than half of all students had success with these items. Year 3 students are still developing their understanding of clause and sentence structure and need explicit teaching to develop their skills in this area. Students should be given explicit teaching about the fact that a single sentence must make sense on its own, i.e. it must be a complete thought. A sentence tells about the process / happening / action (verb) and who or what is involved (noun). Traditionally the two main parts are known as the verb and the subject. The simplest sentence is a clause that stands on its own.

Item 45 required them to understand the metalanguage 'command' and just under 50% of students demonstrated that they understood this. Students had difficulty with item 49, where they were asked which sentence combined all of the information given on a table. Just over 41% of students had success with this item, indicating that further instruction is required for Year 3 students on how to combine information on a table using appropriate conjunctions.

Punctuation

Three items required students to apply their knowledge of sentence boundary punctuation. In item 34 students had to select which sentence required a question mark and 69% of students selected the correct option. Where students were asked to consider both the sentence boundary punctuation, as they were in item 47 (47%), or discriminate the kind of end marks that had to be applied (item 46, 48%), performance was lower.

Punctuation that is internal to the sentences, such as commas in a list and the punctuation of

direct speech, is challenging for Year 3 students. They need to be helped to understand how these kinds of punctuation are used to mark out smaller units of meaning to support a reader, e.g. when

- listing

- inserting a word, phrase or clause

- addressing someone

- starting a sentence with a phrase or clause (*In the morning ...*)

At the word level, item 43 tested an apostrophe of contraction and two thirds of Queensland Year 3 students were successful with this. The item that proved to be most difficult for students was Item 51, which tested their knowledge of punctuating proper nouns. Only 25% of students demonstrated success with this item, a similar number to the national facility rate. This is consistent with results seen in 2013, (item 47, 25%), but much less than was demonstrated in 2014 (item 35, 66% and item 40, 52%). Direct teaching of the capitalisation of proper nouns is required to improve the facility rate for such items.

Implications for teaching

Both grammar and punctuation need to be taught as they are used in reading, writing and speaking. As the grammar test is one of standard Australian English, it is important that students know how different language forms are used in different contexts to establish different meanings. Colloquial forms of the language are often used in questions as distracters, and while students may commonly hear this form in everyday language, they need to know it is usually not acceptable in written language and is unlikely to be correct in the *Language conventions* test. This may provide difficulties for students for whom English is a second language.

Focused instruction about grammar at the word level should occur as part of the spelling program as well as during writing. Knowing the spelling–grammar connection will help students recognise and use nuances of meaning when reading, listening and writing.

In teaching students about grammar, it is important to discuss and learn what the grammatical form is and the part it plays in the construction of meaning. Students need to develop and use the appropriate terms so that there is a common language for sharing knowledge. In reading, students need to be taught how to use this information as the basis of reading strategies, such as when to read on and when to re-read.

In learning about punctuation, students will benefit from being taught the relationship between punctuation and meaning. Explicit teaching of sentence punctuation, particularly as students begin to read and write more complex sentences, remains an important focus. As students write more complex sentences, they can lose their sense of where the boundaries are and need help to identify how and where chunks of meaning should be separated.

Please refer to SunLANDA for a detailed analysis of individual test items, including teaching ideas designed to assist with the development of the understanding and skills required by each item. SunLANDA is available to all schools on the QCAA website.

Reading

Results and item descriptions

The percentage columns give the proportion of correct answers (facility rates).
These results are based on provisional data.

Item	Answer	Qld%	Aust%	Description
Joeys				
1	A	96.5	96.7	Locates directly stated information.
2	C	89.8	90.5	Interprets directly stated information.
3	B	94.2	94.8	Locates directly stated information.
4	A	88.4	89.4	Interprets directly stated information.
5	A	67.2	69.3	Translates directly stated information.
6	D	76.2	77.2	Interprets the main idea of a factual text.
Planet Mess				
7	C	93.3	93.4	Infers the agent of an action.
8	B	89.4	89.4	Integrates directly stated information.
9	C	77.9	77.8	Integrates information to make an inference.
10	B	88.7	89.4	Infers the purpose of an action.
11	D	83.4	84.4	Locates directly stated information.
12	D	84	84.9	Locates directly stated information.
School holiday activities at the library				
13	C	51.1	54.9	Locates directly stated information.
14	B	58.4	61.5	Makes text-based inference.
15	A	73.9	76.8	Translates the meaning of a word (author).
16	A	49.8	51.7	Integrates information to make an inference.
17	D	38.5	41.3	Infers the audience of a poster.
18	C	67.8	70.2	Integrates directly stated information.
Two park signs				
19	D	74.7	77.1	Interprets information from symbols.
20	B	49	51	Infers the intent of a graphic designer.
21	A	68.2	69	Identifies common information across texts.
22	B	44.9	46.6	Infers meaning using cohesive elements in a text.
23	B	49	52.5	Interprets the use of a persuasive device (personal pronoun).
24	C	29.6	30.3	Infers the tone of a persuasive text (poster).
25	D	54.1	56.7	Infers and contrasts the main idea of two texts.

Item	Answer	Qld%	Aust%	Description
The first moccasins				
26	B	62	64.3	Identifies the complication in a folktale.
27	C	41.6	42.5	Interprets directly stated information.
28	A	33.7	34.2	Integrates information to make an inference.
29	D	41	43.7	Integrates directly stated information.
30	D	34.6	34.7	Identifies the folktale text type.
31	C	37.1	37.5	Identifies the main purpose of a folktale.
The storm				
32	D	48.9	50.9	Interprets directly stated information.
33	A	45.3	47.1	Translates directly stated information.
34	B	38.2	39.1	Integrates information to make an inference.
35	C	57.7	59.7	Infers the meaning of figurative language.
36	C	32.3	32.9	Identifies the referent of a pronoun.
37	D	24.4	24.9	Contrasts the purpose of two paragraphs in a story.
38	A	15.6	15.8	Interprets the meaning of a word (eerie).
39	B	22.7	22.7	Integrates information to make an inference.

Key messages

Performance

The 2015 NAPLAN Reading test consisted of 39 items based on 6 units in the Reading magazine. All 39 items were in multiple-choice form. Three units, *Joeys*, *School holiday activities at the library*, and *Two park signs*, were based on informative texts, and the remaining three units, *Planet Mess*, *The first moccasins*, and *The storm*, could be broadly described as narratives, either as folktale, or more conventional story excerpts.

One interesting aspect of the performance of Queensland Year 3 students was an improvement in the items based on narrative texts. With the exception of two items in *The first moccasins* unit, (items 26 and 29), Queensland students were on par with the national means on those items based on narratives. Item 26 essentially required the identification of the main idea (*the problem in the text*), an item type that Queensland students across all year levels have found challenging in past NAPLAN Reading tests. Even so, Queensland students were still within 2% of the national facility rate for this item. A pleasing result was evident on items for the final unit on the paper, *The storm*. This narrative text potentially posed some difficulties for Year 3 readers, in terms of vocabulary, use of figurative language, and cohesion, but despite a high omit rate of about 5% for the questions in this unit, Queensland students performed creditably on its eight items.

Queensland Year 3 students have generally shown a capability in answering items from Information texts, particularly literal questions. The first unit on the 2015 paper, *Joeys*, contained four literal questions, on which Queensland students had around a 90% facility rate. This compared favourably with the national facility rates for these items. The final item in this unit, item 6, required students to identify the main idea of the text, *What is this text mainly about?* Queensland Year 3 students handled this item well, with slightly more than three quarters of students selecting the correct answer.

On the two other units based on information texts, *School holiday activities at the library*, and *Two park signs*, Queensland Year 3 students found the items more challenging. Neither of these texts was in continuous prose, and each required some comparative understanding for particular items. Aspects of layout, design, tone, and visual literacy in general came into play in these units. One interesting result was on item 13, on the *School holiday activities at the library* unit. This text was in the form of a poster advertising a range of holiday activities. Item 13 asked readers:

> *Eva Leung is a cartoonist. Where does Eva regularly publish her work?*

The correct response was option C, in a children's magazine, and the textual clue was: *Eva Leung is famous for her cartoons published regularly in KIDStime magazine*. Only about half of the Queensland cohort selected the correct option, which was below the national mean for this item. The poster referred to the Eva Leung workshop as two entries, for two different days and age groups. It seems likely that many students did not read the second entry thoroughly, it being the one referring to *KIDStime magazine*.

The other more difficult Information text, *Two park signs*, required a higher level of logical reasoning and inference, as a number of items require readers to gauge the **tone** of the signwriter or park administrator. For instance, item 23 asked readers to interpret pronoun use in the sentence:

> *Help us keep it this way by putting all rubbish in the bin before **you** leave.*

The key response was: that responsibility for the park is shared. Slightly under half of Queensland Year 3 students answered this item correctly, and this was also under the national mean. The inferential step of reading 'between the lines' in items of this type was required to answer this item.

There was some gender disparity in Year 3 performance on the 2015 test. In all, girls out-performed boys on 33 of the 39 items, though in many cases the difference was minimal. The item with the greatest difference in terms of gender was item 13, previously discussed. This result confirms the previous trend evident in NAPLAN Reading tests, where boys may not have persisted in the reading process, but rather elected to base an answer on the first reference to the *Eva Leung workshop*, not persevering through to the second reference, where the answer to the question lay. Boys performed most strongly in the final unit, *The storm*. The fact that the protagonist was male, or that this was an adventure story of high risk, may have contributed to this stronger performance. Nevertheless, since boys have historically not performed particularly well on narrative texts of this type, this was a pleasing result.

Implications for teaching

The two units in which Queensland Year 3 students had most difficulty were *School holiday activities at the library*, and *Two park signs*. Both these units used written text in a more direct, or 'clipped' form, and it appears that Year 3 readers may need more classroom exposure and deconstruction of texts of this type. With more conventional text forms, syntactic and semantic clues within complete sentences and paragraphs help clear (and steer) a path for the reader. In the case of signage and posters, students need to be alert to the mix of visual clues (typographic, art work etc.) and the power of the written text. Because of the brevity of words, the vocabulary tends to take on greater power. The *Two park signs* text is a good example of this, where a particular **tone** overlays the commands and directions on the signage. One other important aspect of this type of text is how modality (degree of certainty) is managed by the writer/s. Classroom activities that incorporate examples of how subtle shifts in grammar can have significant impact on meaning would be most worthwhile. For instance, the use of relational verbs (*is*, *are*) in the *Two park signs* text shifts the tone of the text to that of strong command.

Other aspects of the reading process, such as close reading for meaning, extending vocabulary knowledge, and instilling strategies for locating the main idea in a text remain ongoing areas for

instruction, attention, and improvement. The QCAA website (NAPLAN portal) provides teacher advice papers with specific strategies in this regard.

Please refer to SunLANDA online for a detailed analysis of individual test items, including teaching ideas designed to assist with the development of the understanding and skills required by each item.

SunLANDA online is available to all schools through the School portal, also on the QCAA website. Additionally, SunLANDA materials are available to Education Queensland schools through OneSchool.

Year 3 Numeracy

Results and item descriptions

The numeracy strands are abbreviated as follows: Algebra, function and pattern (AFP); Measurement, chance and data (MCD); Number (N); Space (S). All items are worth one score point. The percentage columns give the proportion of correct answers (facility rates). These results are based on provisional data.

Item	Strand	Answer	Qld%	Aust%	Description
1	N	A	95.4	95.5	Matches a pictorial representation to an addition fact.
2	AFP	A	93.4	93.6	Continues a decreasing number pattern.
3	N	D	89.3	90.6	Identifies the cheapest priced object.
4	MCD	D	88.9	89	Calculates the total with numbers expressed in tally marks.
5	MCD	B	83.3	81	Reads a measurement from a centimetre ruler.
6	S	A	85.9	85.7	Uses ordinal numbers to identify an object.
7	MCD	C	69.4	71.5	Uses estimation to identify the number of same-sized objects.
8	S	D	70.2	69.1	Identifies the same shape from a different position.
9	N	B	76	76	Calculates the number midway between two given values.
10	N	C	68	69.6	Compares addition problems to find the largest total.
11	S	C	76.5	76.6	Uses reasoning to determine the missing element in a shape pattern.
12	N	D	64.1	65.2	Interprets a word problem involving addition.
13	MCD	B	59.3	61.2	Interprets a picture graph.
14	S	D	70.1	66.0	Names a 3-D object (shape).
15	N	B	54.2	57.9	Solves a problem involving division or subtraction.
16	S	A	51.4	54.3	Identifies the reflection of a 2-D shape.
17	MCD	B	48.8	50.1	Interprets a calender to solve a time problem.
18	N	A	39.9	42.1	Solves a problem involving subtraction.
19	S	C	49.2	45.5	Determines the number of faces on a solid.
20	MCD	C	39.2	42.8	Recognises a given digital time.
21	N	A	35.6	38.4	Solves a problem involving interpreting 4-digit numbers, ordinal numbers and time.
22	N	A	39.2	42.3	Solves a two-step problem involving addition and subtraction of money.
23	S	B	40.7	43.2	Interprets left and right positions on a graphic.
24	MCD	C	35.8	37.3	Identifies the appropriate estimate for a given mass.
25	N	23	33.6	36.8	Solves a two-step word problem involving addition and subtraction.
26	MCD	20	33.6	34.5	Determines the number of cubes used to make a 3-D object.

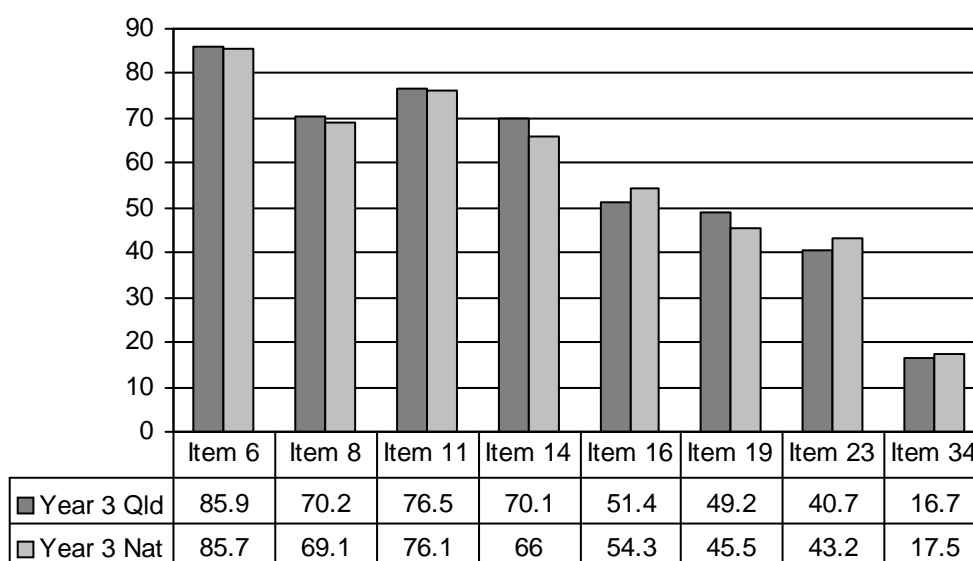| Item	Strand	Answer	Qld%	Aust%	Description
27	MCD	B	48.3	49.8	Uses reasoning to identify the object with the lightest mass.
28	AFP	D	38.6	39.6	Evaluates number patterns to identify the one that matches the given rule.
29	AFP	18	24.2	29	Calculates the missing value in an addition problem.
30	N	C	26.5	28.4	Solves a word problem involving multiplication and division.
31	MCD	5	18.6	20.4	Solves a problem involving interpreting information in a graph.
32	MCD	B	20.6	22.2	Solves a problem involving estimation, interpreting scales and fractions.
33	N	17	13.9	16.6	Solves a problem involving multiplication and subtraction.
34	S	5	16.7	17.5	Interprets a floor plan to identify a given pathway.
35	N	19	5	6.3	Solves a problem involving multiplication, addition and money.

Key messages

Performance

The Numeracy tests cover concepts and skills from across the strands. This year there were 13 *Number*, 3 *Algebra, function and pattern*, 11 *Measurement, chance and data,* and 8 *Space* items.

Encouragingly, there were several items where the Queensland Year 3 facility rate was higher than the national rate and interestingly most of these items came from the *Space* strand. These items tested a range of spatial understandings such as; visualising, describing a location, naming and identifying the attributes of 3-D objects. For two items, 14 and 19, Queensland Year 3 students were nearly 4% higher than the national facility. These two items required students to know the names of common 3-D shapes and to be able to recognise the number of faces on an irregular hexagonal prism, including the faces that could not been seen in the given graphic. However there were two space items where the Queensland result was below by about 3%. These items, 23 and 34, required students to solve problems involving describing locations and movement. For example many of the incorrect responses provided for item 23 demonstrated that students had confused the graphic with real life, so they selected their right-hand-side rather than the right-hand-side of the person represented in the graphic. For young students this would be an easy mistake and teachers may want to provide other assessments to acertain if students are confusing their left and right sides.

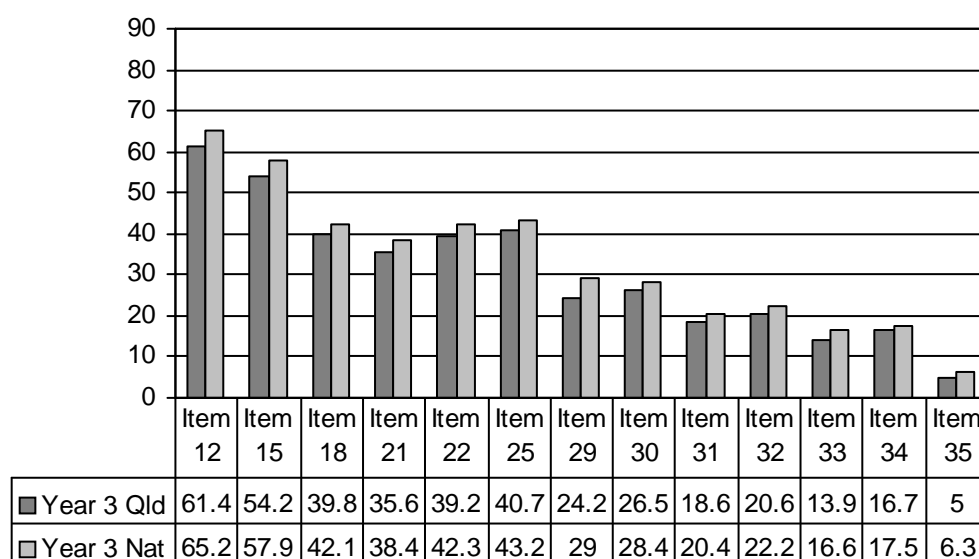Graph 1 shows the comparison between Queensland and the National facility rate for the 2015 Year 3 Space items.

Graph 1: 2015 Year 3 Space items

	Item 6	Item 8	Item 11	Item 14	Item 16	Item 19	Item 23	Item 34
■ Year 3 Qld	85.9	70.2	76.5	70.1	51.4	49.2	40.7	16.7
□ Year 3 Nat	85.7	69.1	76.1	66	54.3	45.5	43.2	17.5

On other items, Queensland Year 3 students were about 3% below the National facility on many multi-step subtraction problems. These types of items continue to highlight the difficulty many students have with solving problems using subtraction as a strategy, for example item 18. This item required students to calculate the number of pages in a book that were **not** read. Students were given the total number of pages and the number of pages read. This item is an example of a 'missing part/addend' type of subtraction question. Many students incorrectly selected 42 as their response, demonstrating that they were confusing the total of 96 with making the total 100. Around 23% of students also demonstrated that they were not renaming the tens when subtracting. Item 29, although an Algebra, function and pattern question, drew again on the relationship between addition and subtraction. Incorrect responses provided showed that many students added the 19 and 8 together but did not subtract it from the 45 to find the missing part of the problem.

There were quite a few word problems on the test this year and many of these required students to carefully read the information presented in both the question and in the diagrams. For item 32, students had to realise that the mass displayed on the scale was the total mass of the two pineapples and therefore needed to be halved to find the approximate mass for one pineapple. Many students (57%) simply assumed that they needed to read the mass shown on the scale. It is important that younger students are taught how to identify the structure and relevant information in worded problems and have some strategies in which they are fluent to solve them.

Graph 2: 2015 Year 3 items involving problem solving

	Item 12	Item 15	Item 18	Item 21	Item 22	Item 25	Item 29	Item 30	Item 31	Item 32	Item 33	Item 34	Item 35
■ Year 3 Qld	61.4	54.2	39.8	35.6	39.2	40.7	24.2	26.5	18.6	20.6	13.9	16.7	5
□ Year 3 Nat	65.2	57.9	42.1	38.4	42.3	43.2	29	28.4	20.4	22.2	16.6	17.5	6.3

Implications for teaching

Teachers may want to include problem solving into their everyday mathematics lessons. It may assist students to become familiar with solving problems that are related to the mathematics they are learning at the time rather than deal with problem solving as a separate entity. Building problem-solving strategies routinely within mathematics lessons may help students link the language of problems to the mathematical thinking and reasoning required to solve them.

Problem solving involves using learned or well-reasoned methods in a logical manner to find solutions. There are different types of problems: routine and non-routine, single step and multi-step.

One of the challenges in teaching problem solving to young children is to ensure they understand the nature of the problem. Students often have difficulty knowing or fully understanding the intent of the problem. Worded problems can be confusing for them if they have had a diet of single-step drill and practice type problems. Students need opportunities to make their own decisions about the mathematics required to solve a problem. Teachers can begin to build students' skills in problem solving focusing on how to interpret problems and identify the mathematics required.

The following table is useful to guide students' thinking when problem solving. Teachers can use this table as a way of helping students analyse and interpret problems like a mathematician. It guides students to use higher order thinking and reasoning.

Where to look	What to do
Above the problem	Think about why the problem may have been chosen and direct attention to what is important and significant, *not* what is obvious or first mentioned. Visualise the problem.
Inside the problem — between the lines	Talk about strategies to help make meaning from the problem and sense of the text, e.g. locate who is doing what and the result of that action, recognise the commands, and the effect of the verbs.
Beneath the lines of the problem	Talk with others to make thinking visible and reflect, refocus attention, identify the underlying structure.
Beyond the problem	Make connections to past experiences, similar problems

Problem solving strategies

Students need access to a range of problem-solving strategies. Students experiment with strategies, make links to the problem types and rate the strategy efficiency for future use. This process builds flexibility and fluency in knowing which strategy is used when and why a strategy is the best fit for the particular problem type.

Multiple opportunities to experiment with strategies in a problem-solving context will build students' repertoire. The following table lists some common strategies. It is important to remember that strategy-driven problem solving may narrow students' fluency with creative problem solving. It is important to acknowledge multiple ways or strategies that can be used to solve the same problem.

Make a visual: picture, diagram, graph	• use information provided and make an illustration to better see the mathematics and connections
Guess and check / trial and error	• use sense of number and common sense to select the substitution • experiment by substituting carefully chosen, logical numbers
Make a list	• list the steps required • make a mind map of ideas around a single starting point making connections to possible strategies, and reasoning
Solve a simpler problem (reduction)	• use numbers that are easy to work with and test out reasoning, then refocus or use the numbers from the problem
Look for a pattern	• look for pattern • analyse the pattern • use the pattern rule
Identify similar problems	• make connections to problems previously encountered and identify similarities and differences • consider special cases when the strategy may not always be the best fit
Eliminate possibilities	• use number sense and common sense to eliminate suggested solutions
Work backward	• use the information provided and work from the total to find the missing part
Write an equation	• represent variables and symbols in problem • use balance to maintain equivalence of both sides
Identify symmetry	• use symmetry to analyse geometric representations • use symmetry to check fraction as visual collections represent equal portions
Substitute into a formula	• use understanding of symbols within the formula to identify the numbers for substitution

Teachers can deepen students' proficiency with problem solving by teaching ways to pose problems. Students will develop insights into:

• the structure of problems

• the problem-solving process

• problem-solving strategies

• problem-solving reasoning.

Through problem posing students develop confidence in mathematical knowledge, procedures

and skills. They learn how problems are constructed, the reasoning behind the structure, the strategies for engaging and ways to talk about the problems so they make sense in problem solving.

Teachers can build a problem-posing culture in the classroom by providing opportunities for students to write problems. For example:

- Students write problems in their spare time and place them anonymously into a *problem box*. At the end of the lesson/day/week empty the box and distribute problems to a group of students to sort and categorise the problem. Allow the students to work out relevant categories. Once the problems are sorted combine the categories with another group until the class has a set of categorised problems. Groups of students select a category and solve the problems. Each group explains the category, reasoning strategies used for that category, the efficiency of the strategies used and modifications of the posed problems to increase/decrease levels of difficulty/reasoning from single step to multistep.

- Students use examples from NAPLAN test papers and change an aspect of the problem. Students will need to think and reason as if they were posing problems. Students can use these as opportunities to try different strategies to find solutions.