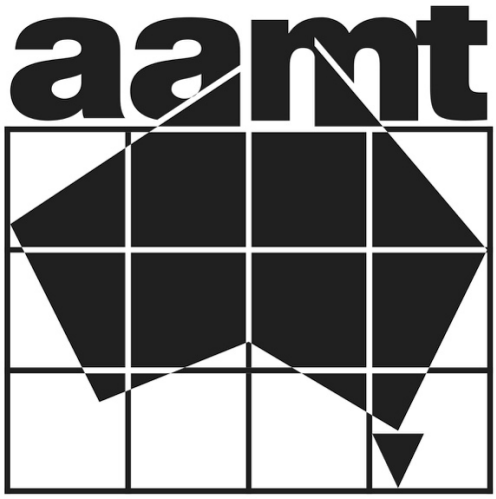

Consultation on National Numeracy Learning Progression (Draft Version 1.1)

AAMT Response, August 2017

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Introduction

The AAMT appreciates being invited by ACARA to provide its comments on this draft of the National Numeracy Learning Progression (NNLP). The initiative responds to an important need in schools and among teachers – how to support students' development of essential numeracy skills and attributes that ultimately underpin effective citizenship and participation in society.

This work fits within a broader emphasis on 'learning progressions'. AAMT takes the view that having 'roadmaps' of student progression are necessary in identifying a student's current learning. Learning progressions in general – and the NNLP in particular – are by no means sufficient, however. Tools that enable teachers to locate students on the progression are essential, as are teaching resources that enable students to progress. This matter is dealt with in more detail fun the Questions section below.

The Draft document was provided to all AAMT Councillors. They are a diverse group of mathematics educators who often wear different 'hats'. In some cases their responses were from the perspective of their day to day work as teachers or in-school leaders. In others, their comments reflected their perspective as people with significant leadership roles in the profession. Both perspectives provide useful input.

'Big picture' comments on the NNLP

Usefulness

As indicated above, AAMT supports learning progressions as important tools for teachers. Indeed, the Association is partnered with the team established by RMIT University under the leadership of Prof. Di Siemon to undertake the development of progressions in mathematics. Given that Prof. Siemon has been part of the development of the NNLP, as has Prof. Jane Watson as a member of the RMIT led team suggests some comfort that their work has informed the current version of the NNLP.

For one respondent with her 'secondary mathematics leader' hat on the "information contained in the Subelements for numeracy will prove very useful for all teachers of mathematics (graduates, experienced educators and out of area teachers). It is possible to move backwards (in the case of me and looking at my very weak Year 10s) and determine at starting point to help the students progress." This is a clear endorsement of the perceived value of the NNLP to secondary *mathematics* teachers.

The statement that the NNLP reflects "aspects of numeracy development necessary for successful learners of the F-10 Australian Curriculum" (p. 3) is accepted by AAMT as a clear statement of the intended purpose of the NNLP. Figure 3 (p. 7) gives a clear visual representation of the progression that respondents indicated would be very useful in informing the necessary conversations about numeracy with teachers from other disciplines in secondary schools in particular. It seems that colleagues from other disciplines can have unreasonable expectations for students' levels of numeracy – the diagram gives a quick picture of what can be expected when.

One respondent noted that the common structure between the NNLP and the parallel literacy document will assist staff in schools to work with both. The three Elements are a sensible 'cut' of numeracy, although this has resulted in an inconsistency that is noted below.

The work to provide advice that links the Subelements of the NNLP to the numeracy demands in the content of learning areas other than mathematics is seen as important support for effective use of the NNLP in those curriculum areas.

Detail and language

The detail provided in the NNLP is generally welcomed. It is noted that more detail is provided in the Early Years, with six Progression Levels for the Foundation year of the AC:M for Quantifying being the most extreme example. Further, virtually all of the instances of multiple progression Levels for a year level in the AC:M are in years F-3. It is hoped that targeted feedback from early years practitioners will help identify whether this level of detail is actually helpful to them (none of the AAMT Councillors works in early childhood, so we are unable to express an informed view on this matter, given the restricted nature of this consultation).

There was some variation in AAMT Councillors' views on the language of the NNLP. One commented that "I found the language used in the document plain and easily understood. I think

this is very important for out of area teachers or primary teachers who are not as informed and passionate about mathematics as other curriculum areas."

Others had different views with one recommending "that a glossary be provided alongside the NNLP, so that understanding of terminology does not impede teachers' use of the progression. Terms that could be included in glossary include: number word, ragged decimal, perceptual counting, perceptual marker, composite unit, quotitive."

The audience for the NNLP is all teachers, and therefore very diverse in terms of their background and knowledge of the technical language of numeracy. AAMT therefore suggests that a glossary would be an important support. We note that ACARA has produced glossaries in the past, so this would appear to be within the scope of what is possible.

Extend as well as remediate

The field of numeracy development is rightly concerned with those students who's progress falls behind for one reason or another. The NNLP will help teachers identify 'where they are' as an essential informant of their efforts to remediate for these students.

However, there are also students on the other side of the fence – students whose numeracy development is above what might normally be expected for their age. The NNLP will be equally useful to the teachers of these students as well, for the same reasons.

One of the AAMT Councillors noted some language in the current draft of the NNLP that suggested the focus of the document is only on the first group of students. Her comments on the document are included in Appendix 1 – Track Changes Comments; a number of these relate to this observation. This is likely to have been unintentional and AAMT suggests the matter can be dealt with relatively easily.

Connection with the Australian Curriculum: Mathematics

Whilst the NNLP is intended to be distinct from the Australian Curriculum: Mathematics (AC:M) there are clear connections. These are both structural, with the Progression indicators linked to a corresponding level in the AC:M, as well as contentual. The indicators therefore can be seen to provide detail for the Content Descriptions at a particular level of the AC:M.

NNLP states that "The Australian Curriculum: Mathematics sets teaching expectations for mathematics learning at each year level, providing carefully paced, in-depth study of critical mathematical skills and concepts."(p. 5)

It goes on to say that "(t)he National Numeracy Learning Progression helps teachers to develop more fine-grain understandings of student numeracy development in the Australian Curriculum: Mathematics."

Whilst these statements in the NNLP make the distinction, it is subtle, and may not be appreciated by teachers and schools. Further, Goss et al[1] (2015) describe the importance of targeted teaching in order to support all students to make appropriate progress in their learning. As advice to teachers and schools these authors further state that "(g)reat teaching will no longer mean masterful delivery of the year level curriculum, but extending the skills and knowledge of every student in every class, regardless of their starting point" (p.5). " Hence, if schools take this advice, teachers are likely to look to the NNLP as the starting point for their teaching, rather than the AC:M as intended.

More generally, whilst the NNLP is intended for all teachers, it has a very mathematical 'look and feel'. Teachers of mathematics may well, and with good intentions, substitute it for the AC:M. This is a real risk that needs further exploration.

The NNLP and the Numeracy General Capability Continuum

There is clear likelihood of confusion in schools and among teachers if the two frameworks are retained. One suggestion would be to map the connections between the two, but this would add complexity. This matter is a real dilemma, but not one on which AAMT is able to provide clear advice at this time.

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[1] Goss, P., Hunter, J., Romanes, D., Parsonage, H., 2015, *Targeted teaching: how better use of data can improve student learning*, Grattan Institute.

Some issues noted in Draft 1.1 of the NNLP

Location of the Time Subelement

The NNLP has Time as a Subelement of Spatial sense. This is not logical as 'time' is not a component of 'space'. The suggestion of renaming the Element as 'Spatial and temporal sense' is probably not advisable as it introduces an other term ('temporal'). Having a fourth element that includes Time and Measurement is a possibility, but would make the NNLP more complex and so is also not advised – better to just live with the illogicality of the compromise in AAMT's view.

Differentiation for diverse learners

In the description of the support provided for teachers to cater for the diversity of learners the NNLP suggest it will "support(ing) teachers to differentiate for students at all stages of schooling." (p. 9) This seems to imply differentiation *between* tasks; differentiation *within* tasks is also a legitimate response, and one that AAMT promotes as equally effective in many cases, and less demanding on teachers.

Operating with percentages

Levels C and D are really two versions of the same (mathematical) construct. Treating them as separate and discrete 'types' of process perpetuates the view that mathematics consists of many separate actions. This approach adds to the load on students. It is suggested that these two be collapsed and rewritten to reflect their connection to a single construct, that of calculating with percentages.

Number Patterns and Properties and Algebraic Thinking Subelements

It is unclear why the Algebraic Thinking Subelement is restricted to secondary school mathematics. it is also noted that 'algebraic thinking' is directly evident in the Progression Levels of the Number Patterns and Properties Subelement from Level D onwards, and implied before that. A single Subelement that merges these two is suggested. It could be Number Patterns and Algebraic Thinking.

Relational Numbers

It seems strange that there are two AC:M links for Progression Level H. What is the explanation? It happens in other places after this in the document, so information on how readers should interpret it would be very useful.

Geometric Properties

Progression Levels C and D are both linked to M4.1. Should the second be M4.2? This is also the first time that two different Progression Levels are linked to the same year level in the AC:M. This apparent anomaly probably needs explanation for readers, as has been suggested above.

Time

Again, it seems anomalous that Progression Level E is linked to both years 6 and 8 of the AC:M, and that there is no connection to year 7. This probably reflects the nature of the Content Descriptions in the AC:M at year 7; a brief explanation may be warranted.

Data

Levels E and F are both linked to level 8 in the AC:M. An explanation similar to the one above for the Geometric Properties subelement is warranted. The second link may need to be labelled M8.2 for consistency as well.

Questions

Note: It is understood that these questions relate to implementation of the NNLP. Given that implementation will be the responsibility of education authorities in the jurisdictions it is not appropriate for ACARA to respond. However, AAMT feels it important to signal matters for implementation at this time and hopes that ACARA can ensure these are noted for attention in the various implementation plans.

Order

Does the order of teaching/learning the progressions matter? Should certain progressions be taught before others?

Support – resources

What support resources are needed? The progressions are quite detailed. For teachers to get maximum benefit from them, much support and guidance will be required. This includes providing accompanying diagnostic/formative assessment tools and appropriate learning tasks that link to the progressions and assessment. We should not expect schools to have the time or capacity to do all of this work themselves. This would be an additional up-front investment, but would have broader benefit, particularly in the case of schools where there is limited pedagogical content expertise.

Support – professional learning

Will there be professional development support (e.g. materials, webinars, etc.) for teachers/school leaders to get started in using the NNLP? Successful implementation will require a targeted approach.

Appendix 1 – Track Changes Comments on Draft 1.1 NNLP

INTRODUCTION

Consultation

This consultation version of the National Numeracy Learning Progression (version 1.1) is provided to key national stakeholders for feedback. Limited consultation is occurring with all state and territory school and curriculum authorities, key national ACARA advisory groups and a selection of numeracy researchers and experts.

Feedback is encouraged that provides specific suggestions for improvements to the progression. The progression is provided in both PDF and Word formats to facilitate feedback in the form of comments and tracked changes.

In addition, ACARA is interested in specific feedback related to the following:

- the suitability of the revised numeracy structure
- new work that links the progression subelements and levels to the year level expectations of the Australian Curriculum: Mathematics
- the advice of your organisation about either retaining or removing ACARA's existing numeracy general capability continuum, following publication of the progression in 2018.

Feedback should be submitted no later than 23 August 2017 to progressions@acara.edu.au

Background

All Australian education ministers agreed in December 2015 to national collaborative action to develop National Literacy and Numeracy Learning Progressions.

> *Extend the national literacy and numeracy continuums to better assist teachers to identify and address individual student needs according to the expected skills and growth in student learning at key progress points from the early years through high school, given the evidence of the spread of student achievement within any classroom.* (Education Council 2015, National STEM School Education Strategy, p. 9)

The Australian Curriculum, Assessment and Reporting Authority (ACARA), in partnership with NSW Department of Education, is leading national collaborative action to develop the progressions from mid 2016 to the end of 2017.

Development

Reflects growing interest in learning progressions

The use of learning progressions is of increasing interest to educators as it builds on other theories of the developmental nature of student learning.

> *A considerable body of research shows that optimal learning occurs when learners are presented with challenges just beyond their current level of attainment. This is what Vygotsky (1978) referred to as the 'zone of proximal development'* (Masters 2013, p. 15).

A learning progression can be described as a common pathway of conceptual development or a sequence for learning or acquiring a new skill.

> *Learning is conceptualised not simply as a matter of acquiring more knowledge and skills, but as progressing toward higher levels of competence as new knowledge is linked to existing knowledge, and deeper understandings are developed from, and take the place of, earlier understandings* (Pellegrino, Chudowsky & Glaser 2001, p. 115).

Based on available numeracy evidence

During 2016, version 1 of the National Numeracy Learning Progression was developed, in consultation with numeracy experts, using available evidence of the learning sequences for numeracy development. Appendices 1–4 outline research used in the development of the progression.

Trialled in Australian schools

Version 1 of the progressions was trialled by 602 teachers in 137 Australian schools between March and May 2017. State and territory school and curriculum authorities nominated trial participants.

Trial participants provided comprehensive feedback about the usability of the progression in locating student numeracy development and determining the learning that should follow.

Validated against NAPLAN student performance data

During late 2016 and early 2017, ACARA mapped NAPLAN test items to the progressions to support validation of aspects of the progressions. This has resulted in specific suggestions for improvement.

Improved based on school trial and validation data

This version (1.1) of the progression reflects improvements made on the basis of analysis of findings from the trial and NAPLAN validation work.

Next steps

From early July to 23 August 2017, consultation on this version of the progression will take place with all state and territory school and curriculum authorities, key national ACARA advisory groups and a selection of numeracy researchers and experts.

Further NAPLAN validation work and the development of linkage advice to the Australian Curriculum learning areas and the NAPLAN performance scale will occur between July and August 2017.

Findings from consultation and further validation will inform the development of version 2 in September 2017. Version 2 will be considered by the ACARA Board in October; Schools Policy Group and AESOC in November; and Education Council in December 2017.

Online publication of the progressions as a resource to support the Australian Curriculum will follow Education Council endorsement.

NATIONAL NUMERACY LEARNING PROGRESSION

Numeracy

Numeracy is fundamental to a student's ability to learn at school and to engage productively in society.

In the Australian Curriculum, students become numerate as they develop the knowledge and skills to use mathematics confidently across learning areas at school and in their lives more broadly. The Australian Curriculum states:

> *Numeracy encompasses the knowledge, skills, behaviours and dispositions that students need to use mathematics in a wide range of situations. It involves students recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully* (ACARA 2017).

Purpose

The National Numeracy Learning Progression has been developed to assist schools and teachers to:

- develop more fine-grain understandings of student numeracy development in the Australian Curriculum: Mathematics, especially in the early years
- differentiate teaching practice to support students whose numeracy development is below the age-equivalent curriculum expectations of the Australian Curriculum: Mathematics
- understand the numeracy demands of the Australian Curriculum learning areas and how the progression can be used to support their students' learning.

The National Numeracy Learning Progression is a resource to support implementation of the Australian Curriculum. Once finalised, state and territory school and curriculum authorities will make decisions about the use of the National Numeracy Learning Progression in their jurisdictions.

Structure

Elements and subelements

The National Numeracy Learning Progression has three elements that reflect aspects of numeracy development necessary for successful learners of the F–10 Australian Curriculum and in everyday life. The three elements are:

- Number sense
- Spatial sense
- Data sense.

Each of the elements includes subelements that present developmental sequences for important aspects of numeracy capability. There are eight subelements in Number sense, four in Spatial sense and two in Data sense.

The diagram (Figure 1) represents the elements and subelements in relation to the numeracy development of the student.

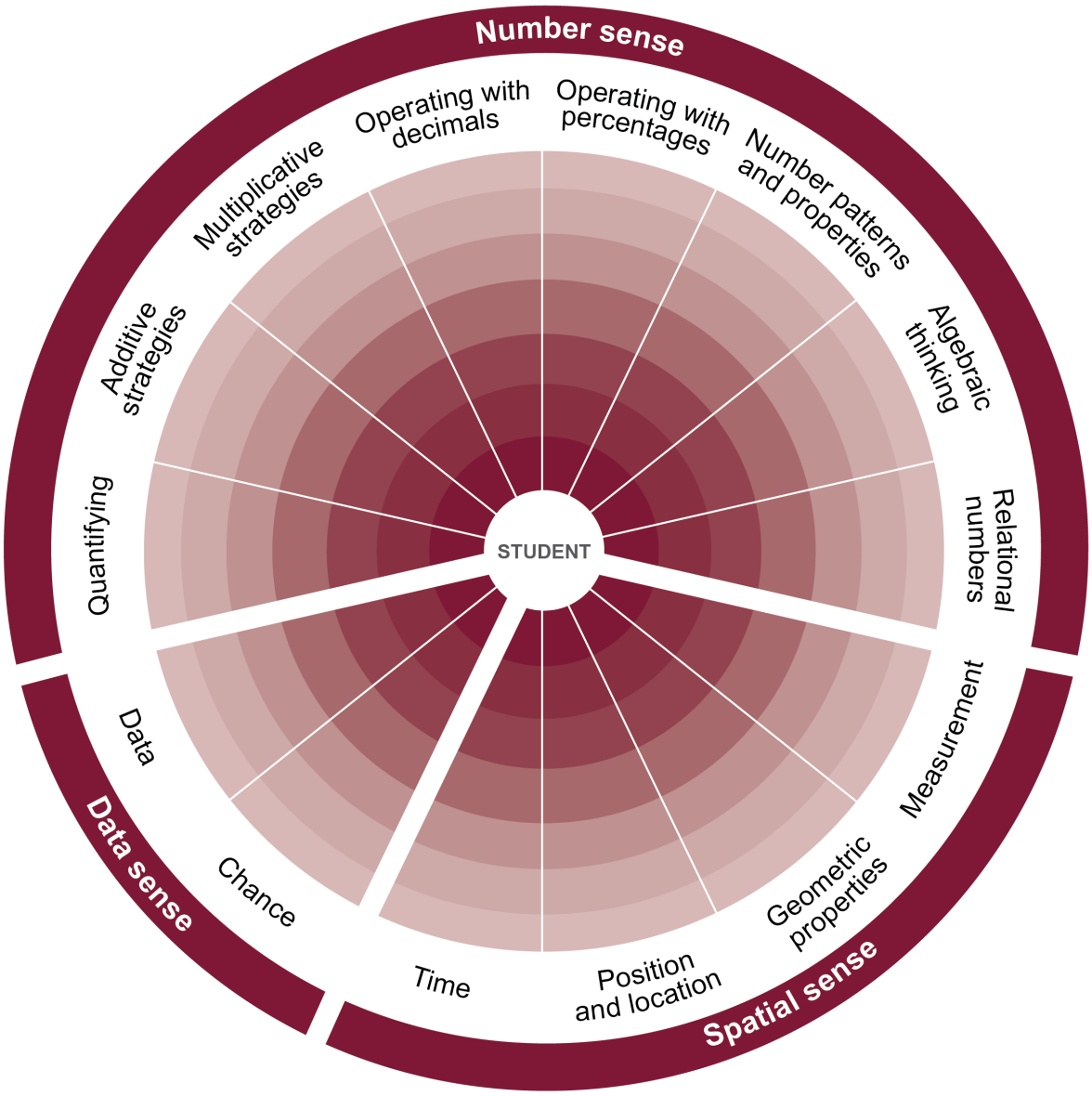

Figure 1. Elements and subelements of the National Numeracy Learning Progression

Levels and indicators

Each subelement has behavioural descriptions called indicators that identify the key observable or measurable indications of numeracy development at increasing levels of sophistication or complexity.

Each indicator describes what a student says, does or produces. Each indicator is written to begin with the implicit stem 'A student …' as the subject of the sentence.

The indicators within a subelement are grouped together to form developmental levels. There are as many levels within each subelement as can be supported by evidence. Each level within a subelement has one or more indicators and is more sophisticated or complex than the preceding level. Each level is coded within the subelement by a sequential letter of the alphabet.

The listing of indicators within a level is non-hierarchical. However, in each subelement, subheadings are shown in bold. Subheadings have been included to assist teachers by grouping indicators into particular skills that develop over a number of levels or by highlighting important concepts that appear at certain levels.

The amount of time it takes students to progress through each level is not specified since students progress in numeracy development at different rates.

The levels do not describe equal intervals of time in students' learning. They are designed to indicate the order in which students acquire the knowledge and skills necessary to be numerate. As learning is very rapid in the early years of school, the initial levels tend to be more detailed than the later levels.

Moreover, the amount of detail in any level or subelement is not an indication of importance. A single indicator at a higher level in the progression may rely on a substantial number of indicators being evident in earlier levels.

Relationship to the Australian Curriculum

In the Australian Curriculum, learning area content describes the knowledge, understanding and skills that are to be taught in each year or band of years. Achievement standards describe the learning expected of students at each year level or band of years. The content and achievement standards continue to be the focus for planning, programming, teaching, learning and assessment in relation to the Australian Curriculum.

While much of the explicit learning underpinning numeracy occurs through the content of the Australian Curriculum: Mathematics, all learning areas require the application of discipline-specific numeracy knowledge and skills.

Australian Curriculum: Mathematics

> *The Australian Curriculum: Mathematics provides students with essential mathematical skills and knowledge in number and algebra, measurement and geometry, and statistics and probability… Mathematics is composed of multiple but interrelated and interdependent concepts and systems which students apply beyond the mathematics classroom …* (Australian Curriculum: Mathematics, Rationale 2017)

The Australian Curriculum: Mathematics sets teaching expectations for mathematics learning at each year level, providing carefully paced, in-depth study of critical mathematical skills and concepts.

The National Numeracy Learning Progression helps teachers to develop more fine-grain understandings of student numeracy development in the Australian Curriculum: Mathematics, especially in the early years. It can be used to guide differentiation of teaching practice to support students whose numeracy development is below the age-equivalent curriculum expectations of the Australian Curriculum: Mathematics.

This version of the National Numeracy Learning Progression has been mapped to the Australian Curriculum: Mathematics.

Figure 2 provides an example of a subelement that has been annotated to show particular features of the progression structure.

In the left hand column each subelement level has been identified by a sequential letter of the alphabet. The centre column provides the listing of progression indicators within each level. The right hand column shows the relationship of the subelement level to the Australian Curriculum: Mathematics year level expectation. The first symbol of the code is M for Mathematics; the second symbol is the Mathematics year level (F=Foundation, 1=Year 1) and the third identifies the sequence of levels related to the same Mathematics year level.

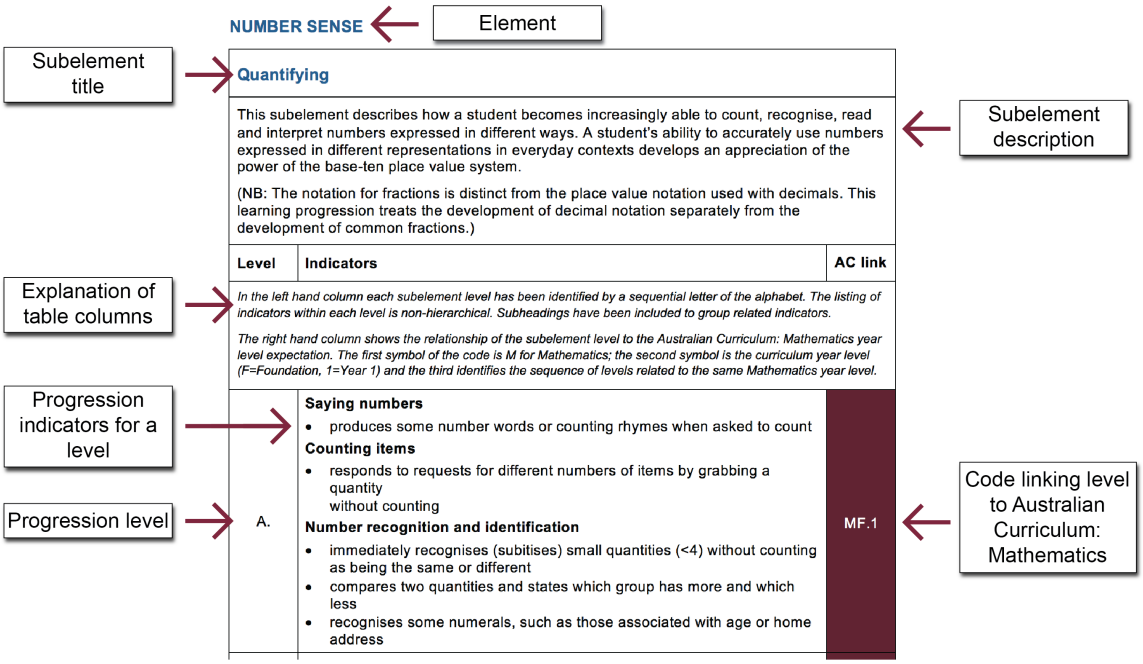

Figure 2. Annotated example of a numeracy subelement

The relationship of the developmental sequence of each subelement, compared to the year level expectations set by the Australian Curriculum: Mathematics, is represented in the diagram at Figure 3.

Some subelements are developed from Foundation Year, others such as Operating with decimals, Operating with percentages and Algebraic thinking are not introduced in Mathematics until upper primary years. Some are explicit in the curriculum to Year 10, others stop much earlier.

Using the subelement of Additive strategies as an example, addition and subtraction of whole numbers is explicit in the Foundation to Year 4 Australian Curriculum: Mathematics. However, students make progress at different rates. Some students may demonstrate achievement of the Additive strategies developmental sequence earlier than Year 4. Other students may require ongoing teaching support for a number of years beyond Year 4 to successfully demonstrate the transition from count-by-one methods to flexible regrouping of numbers in addition and subtraction.

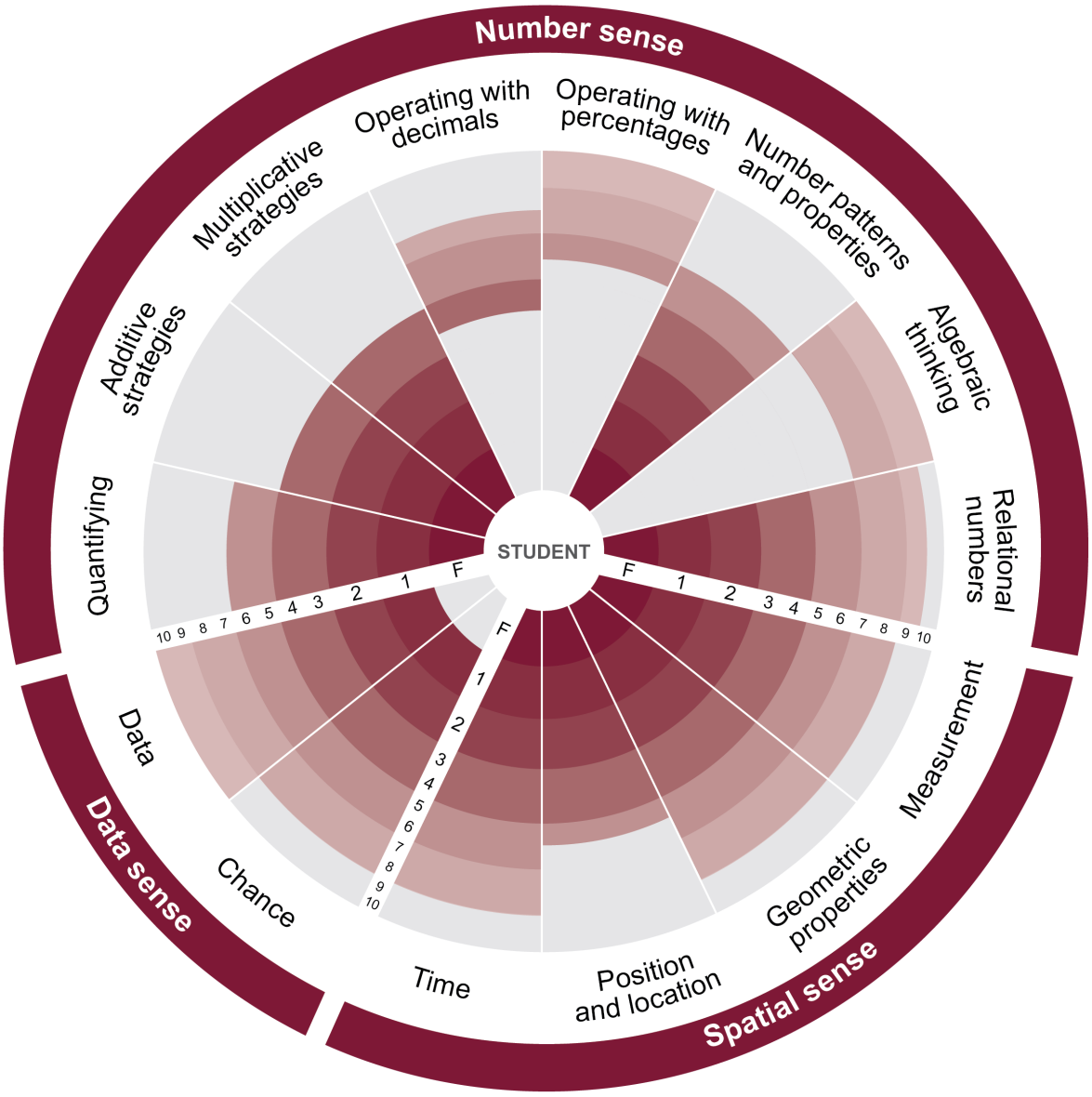

Figure 3. The relationship of the subelements of the National Literacy Learning Progression to the year level expectations of the Australian Curriculum: Mathematics

Other Australian Curriculum learning areas

This National Numeracy Learning Progression is designed to assist schools and teachers in all learning areas to support their students to successfully engage with the numeracy demands of the F–10 Australian Curriculum.

Following feedback received in the school trial of version 1, ACARA has undertaken to strengthen advice to show how subelements of the progressions link to the numeracy demands of the Australian Curriculum learning area content in F–2, 3–6 and 7–10. ACARA will be working with learning area experts during August to develop learning area–specific advice. This advice will be presented in version 2 at the subelement level as an online learning area view.

General capabilities

The National Numeracy Learning Progression is different from the existing general capability continua in both structure and intended use. Concurrent online availability of both the numeracy progression and the numeracy continuum from 2018 has the potential to be confusing for schools and teachers.

From July to August 2017, ACARA will consult with key stakeholders to determine the relationship and future directions of both the numeracy progression and the existing numeracy general capability continuum, prior to approval of version 2.

Using the National Numeracy Learning Progression

The National Numeracy Learning Progression can be used at a whole school, team or individual teacher level. However, the school trial feedback indicated that the progression provides maximum student learning benefits when used as part of a whole-school strategy that involves data sharing, professional learning and collaboration between teachers.

There is no one approach to teaching and learning. Figure 4 shows how the progression can be used in the four phases of the teaching and learning cycle.

It is important to note that the learning area content and achievement standards continue to be the focus for planning, programming, teaching, learning and assessment in relation to the Australian Curriculum. The learning progressions do not describe what to teach. The progressions provide a detailed map of how students become increasingly sophisticated in particular aspects of numeracy development.

In the diagram, the top left quadrant focuses on identifying what students already know and can do and the top right quadrant focuses on what Australian Curriculum content students are to learn. The bottom right quadrant focuses on how students will learn and the bottom left quadrant on how student learning will be assessed.

The four outer boxes of the diagram outline how the numeracy progression can be used in relation to each of the four phases.

The top left box describes how the progressions are used to locate the current numeracy development of each student and to identify the numeracy learning that follows.

The top right box identifies that the progression can help teachers to think about the sophistication of numeracy skills needed to learn specific learning area content and the readiness of students to engage successfully with these numeracy demands.

The bottom right box encourages teachers to use the progressions to think about the numeracy support that some or all students may need to access the content.

The bottom left box focuses on teachers considering the features of the numeracy skills to be demonstrated in learning area assessments and how explicit numeracy feedback can be given.

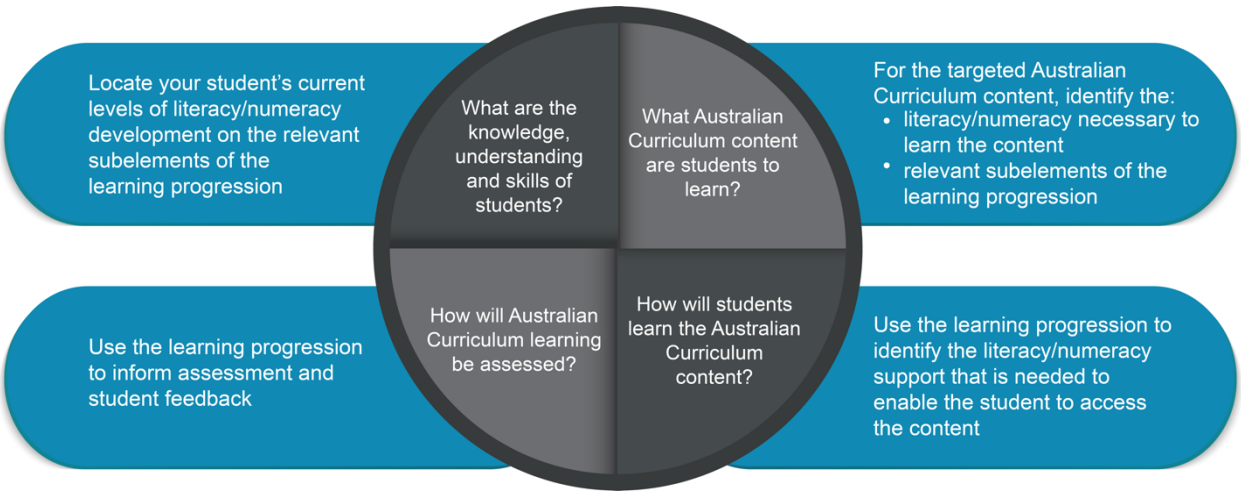

Figure 4: Using the learning progressions to support teaching and learning of all Australian Curriculum learning areas

Locating students on the progression

The numeracy progression has 14 subelements. Student development on each subelement will not necessarily occur evenly.

When locating the level of a student's numeracy development within a subelement, teachers are encouraged to make a holistic judgement. This judgement is based on the overall picture created by a group of indicators at a level being the best match to the evidence demonstrated by the student. Remember, indicators at a level are not a prescriptive list and the progression is not designed to be used as a checklist.

A diverse range of learning opportunities, such as number talks, written or oral explanations, or performance tasks from any learning area, can provide suitable student evidence.

Teachers may find it helpful to start with the Australian Curriculum: Mathematics year level expectations but it is important to make sure that these expectations do not overly influence judgement. Researchers, including Masters, indicate that the most advanced students in a year of school may be as much as five to six years ahead of the least advanced students.

Diverse student learners

The National Numeracy Learning Progression is a resource to support the implementation of the Australian Curriculum, assisting teachers to design rigorous, relevant and engaging learning programs that address students' individual learning needs.

Consistent with ACARA's Student diversity advice on the Australian Curriculum website, the numeracy progression supports teachers to cater for the diversity of learners by:

- acknowledging students' different rates of progress through the levels and across elements
- acknowledging different starting points in students' numeracy learning development
- supporting teachers to differentiate for students at all stages of schooling.