Every student can learn maths:

Recognising core numeracy skills in students with diverse additional learning needs

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Learner at the centre

- All students have a right to high quality education
- Quality education requires highly skilled teachers to suit the individual and diverse learning needs of students
- High quality assessment helps teachers identify the existing skills of students
- Assessments that develop a continuum of skills assist teachers to identify the content that a student might be ready to learn next

Why is maths so important?

- Numeracy is defined by OECD (2012) as 'ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a range of situations in adult life'

- Children have innate number abilities (Izard et al, 2009) and build on these to construct mathematical ideas through cognitive development and interaction with their environment (Geist, 2010)

- Poor numeracy is associated with a negative impact on an individual's chance of school completion (Parsons & Bynner, 1995)

- Longitudinal research found individuals with poor numeracy are less likely to own their own home, have a higher risk of depression and if employed are more likely to be in semi-skilled or unskilled jobs (Bynner and Parsons, 2005)

The challenges in schools

- One in 20 students receive additional funding through the Program for Students with Disabilities, but a further one in five students require adjustments to their learning (Victorian Auditor-General, 2012)

- Teachers feel a lack of support for teaching students with additional needs (VEOHRC, 2012)

- 11 years after the introduction of the 2005 Disability Standards for Education (Cth), students with additional needs are not being provided adequate instruction and access to learning (Senate Committee, 2016; Victorian Equal Opportunity & Human Rights Commission, 2012)

Assessing via NAPLAN

2.1 NAPLAN is a national assessment, and all students are expected to participate. NAPLAN should be accessible to all students to demonstrate their actual skills and knowledge.

Disability adjustments should be granted that are appropriate for students to access and participate in the tests.

- Adjustments should not compromise the ability to assess the underlying skills that are the objects of the assessments, as outlined in Section 6.2.3.

•1.8% of Australian grade 3 students were exempt from the NAPLAN numeracy test in 2015

•3.7% of Australian grade 3 students did not meet the national minimum standard in the NAPLAN numeracy test in 2015

How is the learning of these 5.5% of Victorian students measured?

Measuring the learning of students who are exempt

- Presently no empirically validated numeracy assessments designed specifically for students with additional learning needs are available

- Assessments designed for students with additional needs often feature long checklists, can be time consuming and don’t help teachers know the content to teach next

- Assessments that start at foundation level do not always cater for students with additional needs. They may not allow these students to demonstrate what they know and can do.

Quality assessment

- Well designed assessments direct teacher attention to the important skills and measure them consistently

- Judgement-based methods of assessment capitalise on teachers' experience and knowledge of their students to accurately observe students with additional needs (Woods, 2014)

- Framing teacher judgement within a criterion-referenced framework (Griffin, 2014) allows teachers to view student progress against a continuum rather than make unhelpful comparisons to typically developing students

Learning progressions

- Vygotsky (1929/1993) argued that identifying students' emerging skills and scaffolding learning appropriately will have the greatest impact on student learning

- A learning progression is a road or pathway that students travel as they progress towards mastery of the skills in the domain

- A progression designed for students with additional needs helps to see movement (forwards and backwards) and avoid unhelpful comparisons to 'bench marks' or 'norm-referenced' standards (Griffin, 2014)

- Learning progressions assist with coherence (Black, Wilson & Yao, 2012) and avoid 'haphazard' and disconnected planning and teaching (Heritage, 2008)

The design of an assessment for emergent numeracy

- This study replicates the methodology used to design assessments for a similar cohort in communication, literacy, interpersonal learning and intrapersonal development (Woods & Griffin, 2014)

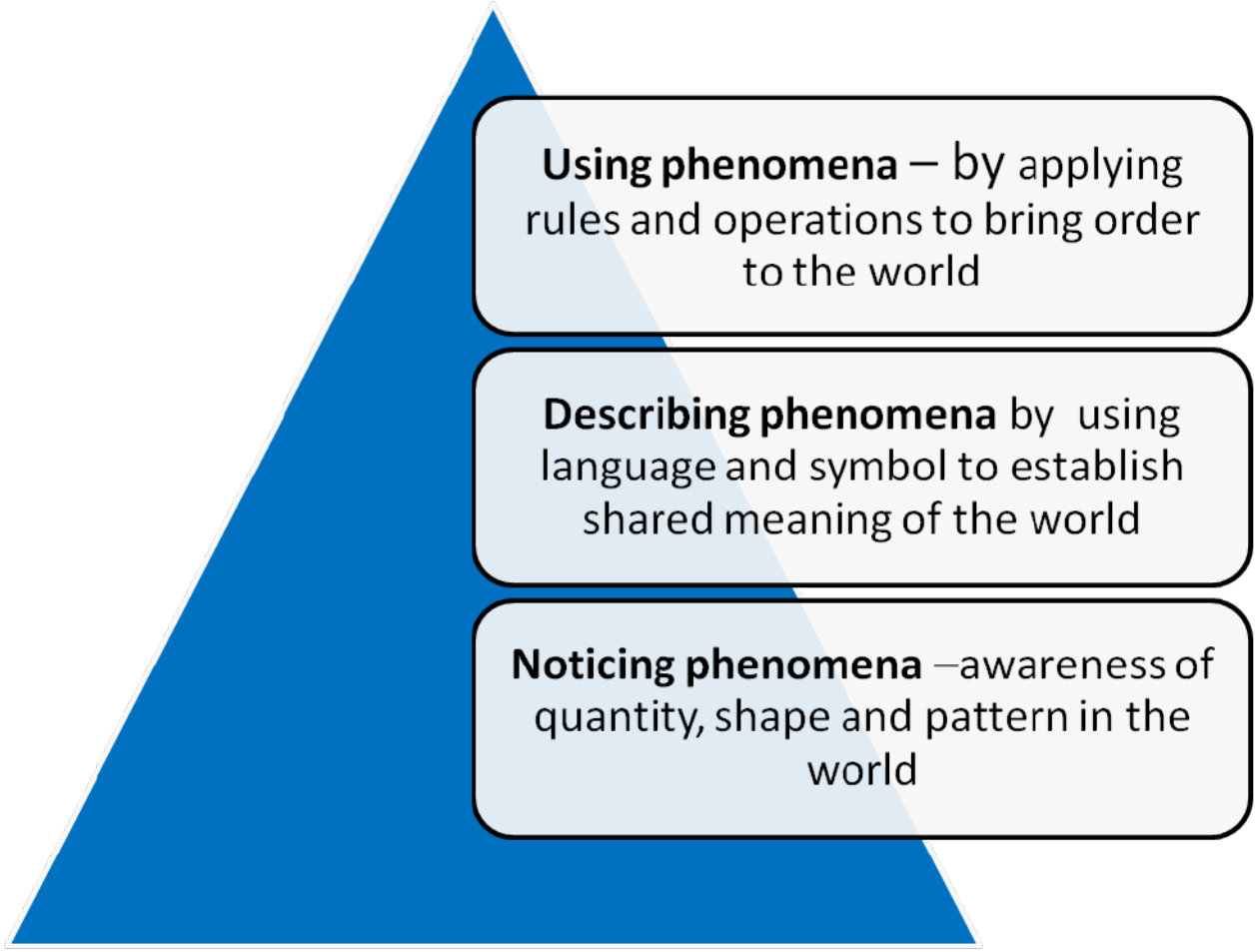
- The design uses teacher observation of student behaviour in numeracy to measure increasing sophistication in a range of skills

- Comparing across many skills allows judgements to be made on the relative difficulty of steps (quality criteria) in questions (items) and a hypothesised framework be developed

- Data of actual performance on the items is compared to the hypothesised framework to see how reliable the items are at predicting student ability and detect whether the questions favour or disadvantage particular groups of students (i.e., students with ASD)

Defining the construct (what we are measuring)

Using symbolic representation of quantity, shape and pattern to bring order to the world.



An example item from the assessment

15. Comparing objects by size	
15.3	Explains the difference between object sizes using comparative terms (e.g., bigger, smaller, longer, shorter, wider, broader, heavier, lighter)
15.2	Compares the size of two objects (e.g., by touching or looking at) and says, signs or indicates which is bigger or smaller
15.1	Explores different sized objects with guidance (e.g., touching, looking at)
15.0	Is moving towards, but has not yet achieved, these skills/behaviours

The assessment design process

- Literature on emergent numeracy and curriculum documents were reviewed to define the learning area and select the content
- Subject matter experts (both experienced special education teachers and numeracy academics) attended workshops to draft the construct and items
- Drafted questions (known as items) were panelled with experienced item writers and piloted in schools to check for clarity and understanding with teachers
- Schools were invited to participate in the trial via visits and phone calls
- Items were programmed onto the assessment platform and schools commenced assessing their students

Recruitment and participation in the trial

Recruitment

90 school principals invited from

a)Victorian special schools

b)Primary and secondary schools with a sizable cohort of students with a disability, who are past users of ABLES

Participation

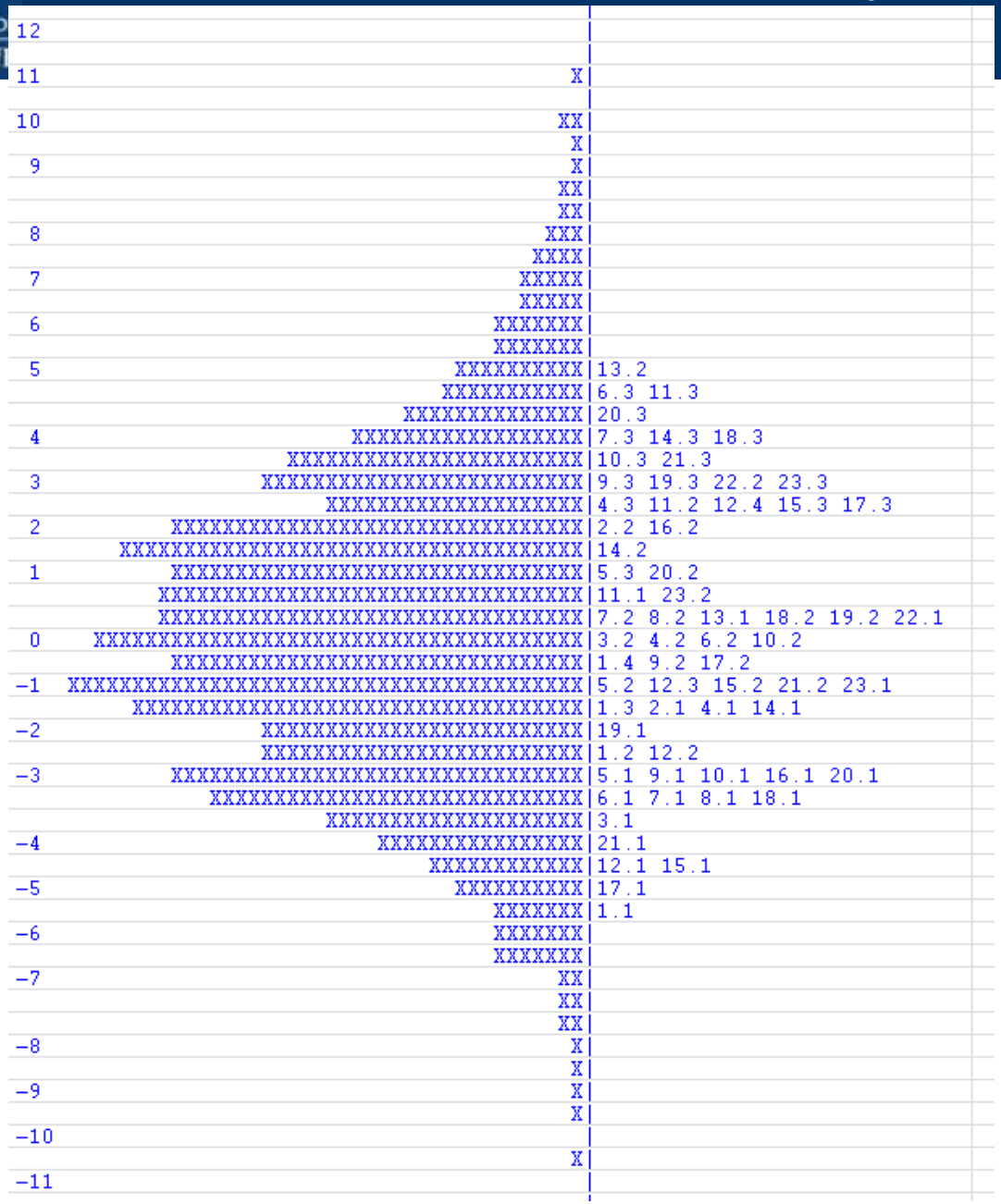
2597 students from	Number of schools
Primary schools	9
Special schools	15
Specialist schools	13
Special developmental schools	19
Autism spectrum disorder schools	5
Physical disability schools and school for the deaf	5

Maths trial demographics

Mean score out of 65	33	
Gender	72% males	28% females
Mean age Std. deviation	12 years 3.6 years	
School types	Special setting 94% Mainstream 6%	

Disability category	Percentage of students
ASD	54%
Physical disability	19%
Vision impairment	8%
Severe behaviour disorder	7%
Hearing impairment	5%
Intellectual disability	72%
Severe language with critical educational needs	25%

Variable Map



3.4% (74) of students scored 65

2597 students assessed

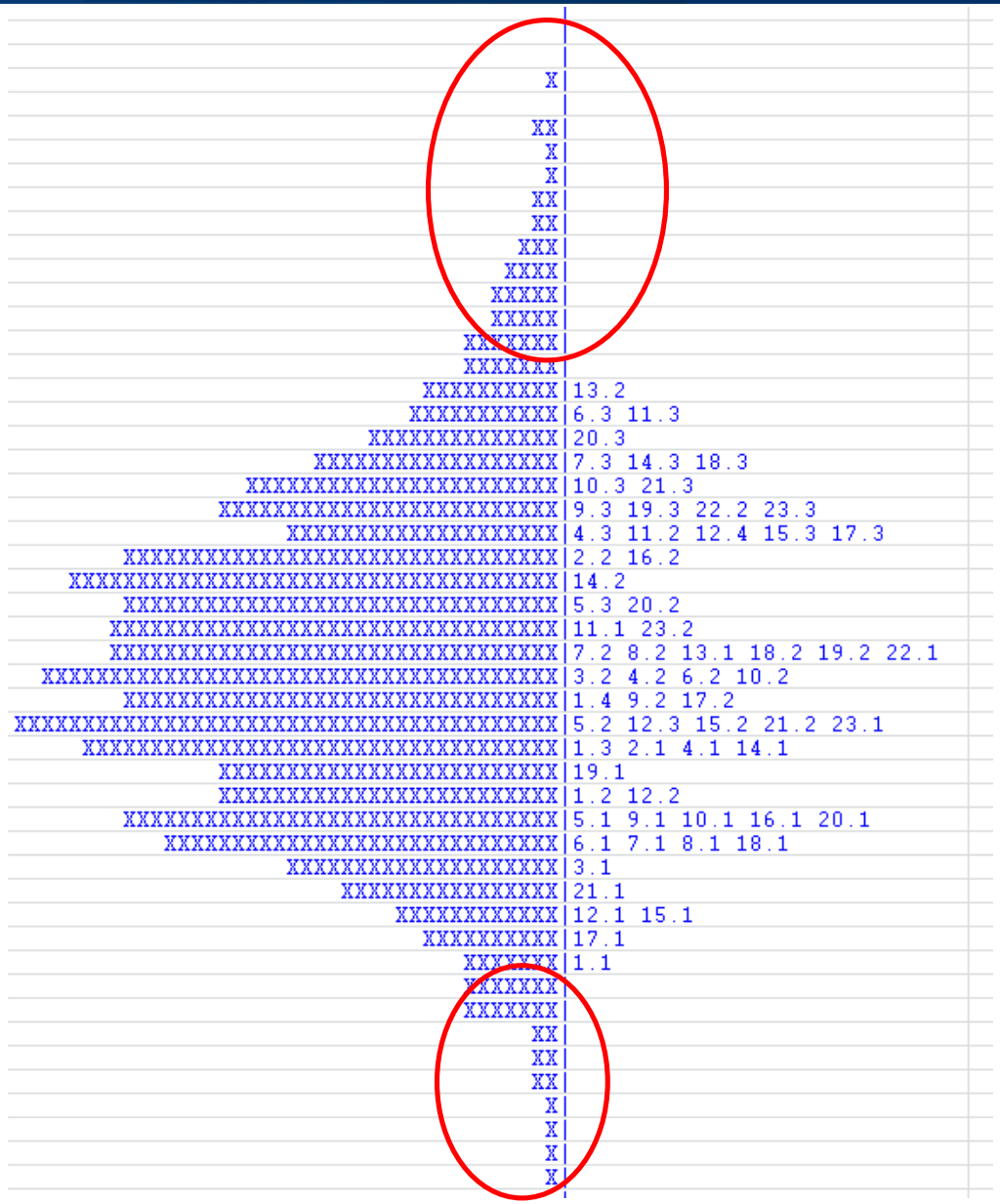
Each ‘X’ represents 4 students

The numbers represent the items and their steps

The higher the item the fewer students achieved that item

2.3% (50) of students scored 0

Catering for all students



The crosses in the red circles represent students who had more than 50% probability of being able to demonstrate all or none of the behaviours

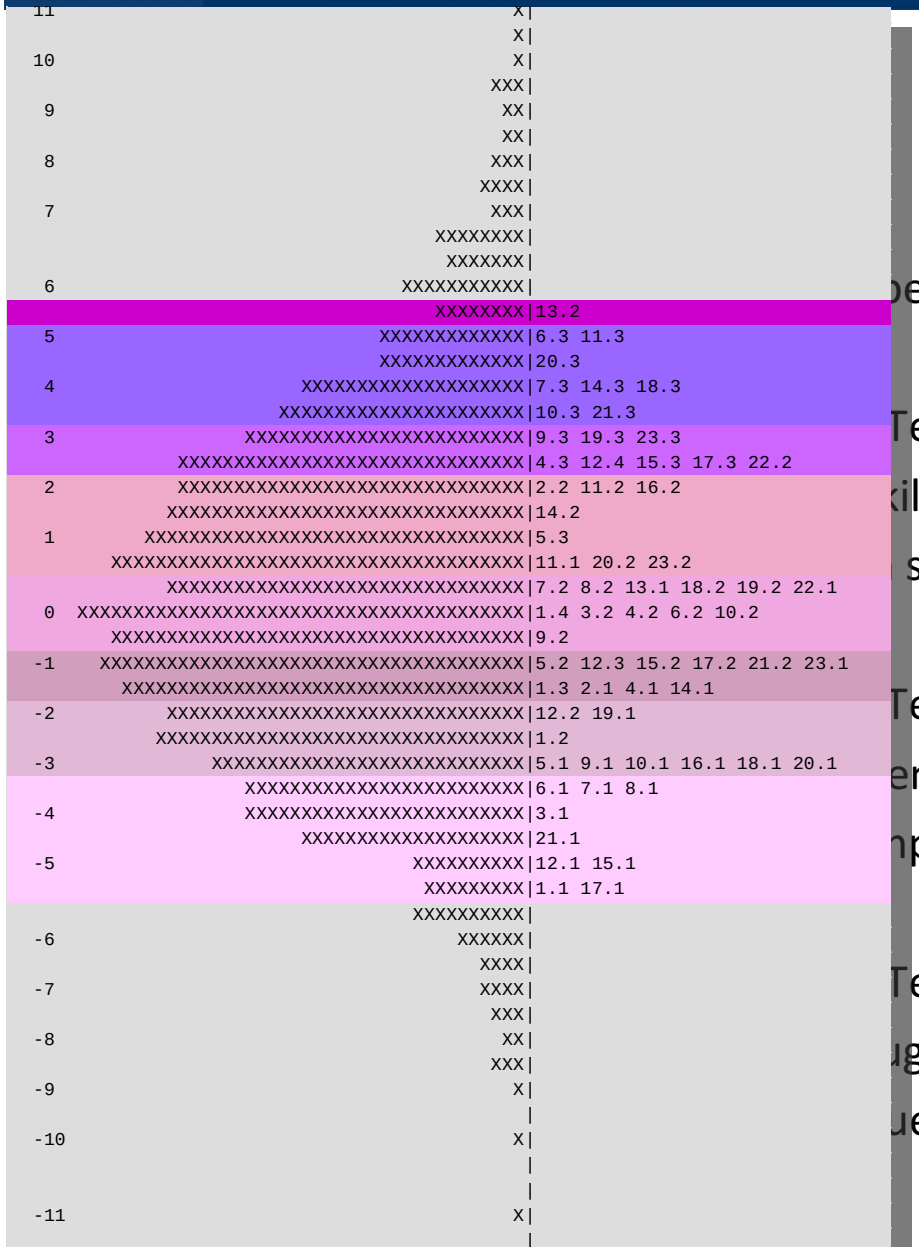
A score of 0 or full marks gives the teacher no information to inform their teaching

IN RESPONSE…

Items have been written in an attempt to cater for these students

They are being trialled at present

Interpretation workshop



- After initial data analysis a

was held with experienced

pecial education teachers

Teachers separated the

kills into conceptual levels (shown

shades of pink)

Teachers were asked to review

ems with poor fit and make

provements to their clarity

Teachers were asked to make

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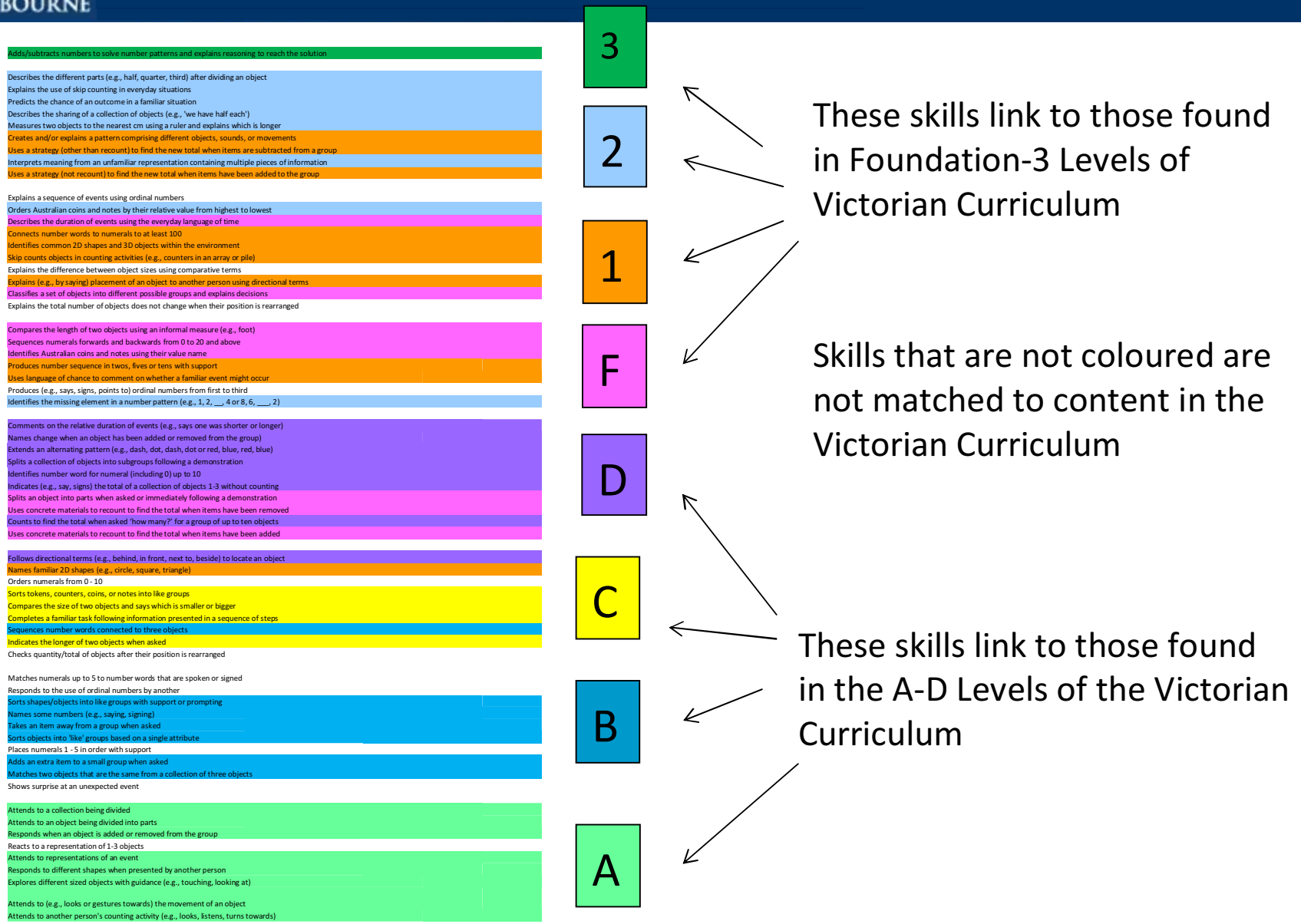
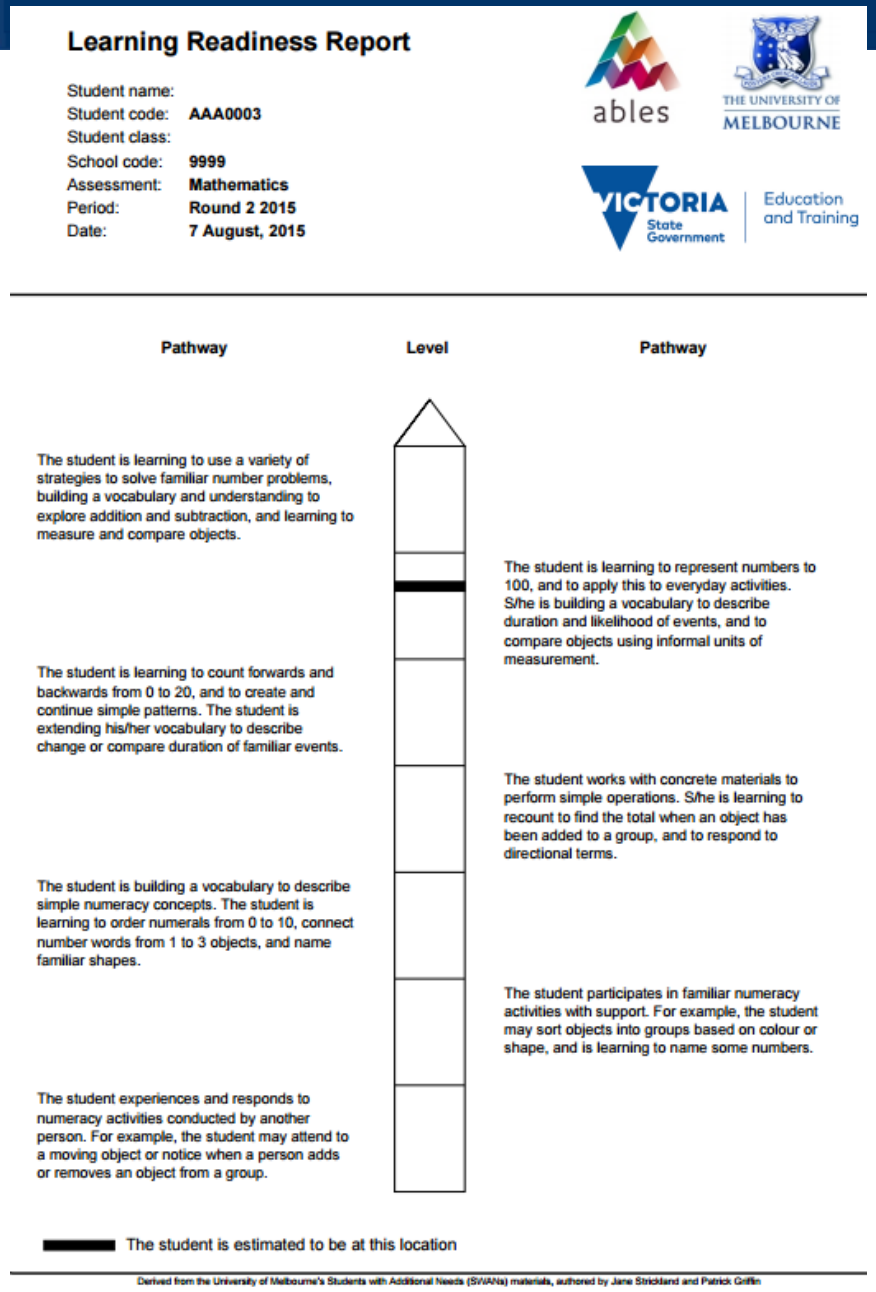
Mapping the progression to the Victorian Curriculum



Information provided to the teachers



Learning Readiness Report

Student name:
Student code: **AAA0003**
Student class:
School code: **9999**
Assessment: **Mathematics**
Period: **Round 2 2015**
Date: **7 August, 2015**

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Pathway	Level	Pathway
The student is learning to use a variety of strategies to solve familiar number problems, building a vocabulary and understanding to explore addition and subtraction, and learning to measure and compare objects.		
		The student is learning to represent numbers to 100, and to apply this to everyday activities. S/he is building a vocabulary to describe duration and likelihood of events, and to compare objects using informal units of measurement.
The student is learning to count forwards and backwards from 0 to 20, and to create and continue simple patterns. The student is extending his/her vocabulary to describe change or compare duration of familiar events.		
		The student works with concrete materials to perform simple operations. S/he is learning to recount to find the total when an object has been added to a group, and to respond to directional terms.
The student is building a vocabulary to describe simple numeracy concepts. The student is learning to order numerals from 0 to 10, connect number words from 1 to 3 objects, and name familiar shapes.		
		The student participates in familiar numeracy activities with support. For example, the student may sort objects into groups based on colour or shape, and is learning to name some numbers.
The student experiences and responds to numeracy activities conducted by another person. For example, the student may attend to a moving object or notice when a person adds or removes an object from a group.		

The student is estimated to be at this location

Derived from the University of Melbourne's Students with Additional Needs (SWANs) materials, authored by Jane Strickland and Patrick Griffin

This report is generated to visualise and describe the conceptual level the student is at, and adjacent levels

In July, a large workshop with teachers will be held to connect teaching advice to each of these levels

A trial of revised items (including some that are harder and easier) is underway to cater for a broader cohort of students

Learner at the centre

This assessment ultimately places the learner at the centre, because it:

- Recognises skills not described by other assessments
- Gives teachers the resources to observe the skills of each student
- Places the student on an empirically derived numeracy progression
- Will eventually give teachers advice on how to plan lessons centred on the needs of each student

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