Victorian Academy
of Teaching and Leadership

Numeracy Improvement at Lilydale Heights College

Improvement resulting from practice and cultural shifts, driven by both the Mathematics faculty and whole school change

Victorian Academy of Teaching and Leadership

Then

Then,
Now,
Next

LILYDALE HEIGHTS COLLEGE

Getting started

Challenges identified

Professional learning undertaken (Bastow/Academy)

Numeracy Team established

5-year plan developed

| 2018	2019	2020	2021	2022
CONSOLIDATING: **Team Planning** - Divide planning amongst team - Mini fortnightly planning sessions to review/refine - Incorporate the real life context at the beginning to engage	**EMBEDDING:** **Team Planning** - Continue to divide planning amongst the team & value add - Refine use of real life contexts at the beginning to engage - Use four proficiencies in the planning	**EMBEDDING:** **Team Planning** - Continue to divide planning amongst the team & value add - Refine use of real life contexts at the beginning to engage - Use four proficiencies in the planning	**EMBEDDING:** **Team Planning** - Continue to divide planning amongst the team & value add - Refine use of real life contexts at the beginning to engage - Use four proficiencies in the planning	**EMBEDDING:** **Team Planning** - Continue to divide planning amongst the team & value add - Refine use of real life contexts at the beginning to engage - Use four proficiencies in the planning
INTRODUCING: **Shared Numeracy Vision amongst Maths Faculty** - Establishing a shared vision for the college - Learning from outside sources (including the four proficiencies, growth mindset) - Using our data (student shadowing) to set direction	**CONSOLIDATING:** **Shared Numeracy Vision** - Refine shared numeracy vision amongst Maths teachers - Consolidate our use of the four proficiencies and seven positive norms - Act on our data	**EMBEDDING:** **Shared Numeracy Vision** - Reinforce shared numeracy vision amongst Maths teachers - Embed our use of the four proficiencies and seven positive norms - Collect and act according to student data	**EMBEDDING:** **Shared Numeracy Vision** - Reinforce shared numeracy vision amongst Maths teachers - Embed our use of the four proficiencies and seven positive norms - Collect and act according to student data	**EMBEDDING:** **Shared Numeracy Vision** - Reinforce shared numeracy vision amongst Maths teachers - Embed our use of the four proficiencies and seven positive norms - Collect and act according to student data
	INTRODUCING: **Student voice/Number talks** - PD Maths teachers on value and application of number talks - Look at role of students in setting their own goals - Students actively participate in learning process/design	**CONSOLIDATING:** **Student Voice/Number Talks** - Maths Teachers plan and use number talks to enrich the learning in their classes - Students set and act on maths goals - Students are active contributors in curriculum design	**EMBEDDING:** **Student Voice/Number talks** - Maths Teachers plan and use number talks to enrich the learning in their classes - Students set and act on maths goals - Students are active contributors in curriculum design	**EMBEDDING:** **Student voice/Substantive talk** - Maths Teachers plan and use number talks to enrich the learning in their classes - Students set and act on maths goals - Students are active contributors in curriculum design
		INTRODUCING: **Maths across the Curriculum** - Faculty areas identifies maths in action across the curriculum - The transferrable skills and cross curricular connections with maths are identified - Maths teachers coach staff in other faculties to develop mathematical learning	**CONSOLIDATING:** **Maths across the curriculum** - Faculty areas identifies maths in action across the curriculum - The transferrable skills and cross curricular connections with maths are identified - Maths teachers coach staff in other faculties to develop mathematical learning	**EMBEDDING:** **Maths across the curriculum** - Faculty areas identifies maths in action across the curriculum - The transferrable skills and cross curricular connections with maths are identified - Maths teachers coach staff in other faculties to develop mathematical learning
			INTRODUCING: **Maths in local community and industry** - Identify ways maths is used by local businesses and industry - Students to make links with family/friends in local	**CONSOLIDATING: Maths in local community and industry** - Students identify pathways involving mathematics in their local community - Students use their maths skills in their future pathways
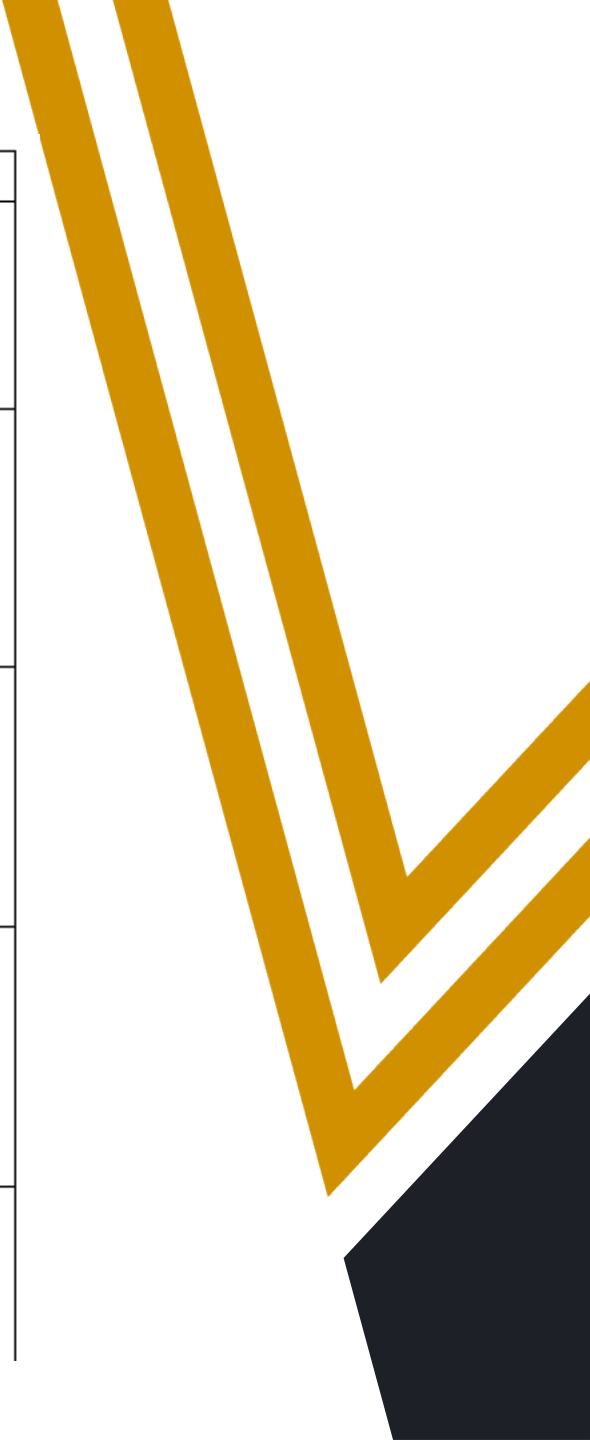
Stage 1 – Mathematics Faculty focus

To improve teaching and learning in all Mathematics classrooms

Mathematics Faculty

Goals

> Develop a shared vision

> Document curriculum incorporating agreed strategies

> Improve student ownership of data
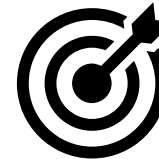
Your turn:
The ideal Numeracy learner

On your own

On separate post-it notes, identify 3-5 characteristics of the ideal numeracy learner.

As a group

As a group, identify any similar characteristics you came up with and group them together.

Refine

As a group, select your top 3 characteristics.

Developing a shared vision

What makes a great Maths learner?

Attribute	Examples
Risk-taker	• "What would happen if we tried this?" • Mistakes are okay • Resilient/persistent • Open to learning from mistakes • Doesn't always follow set procedures – has a go at using other creative ways
Curious	• Wants to know more • Independent investigation • Open-minded • Asks questions • Makes connections • Not bored (if provided with engaging/challenging activities)
Reflective/makes connections	• Applies learning in new situations • Can see connections between concepts • Identifies new learning • Self-assessing • Sees bigger picture
Problem-solver	• Willing to take on more challenging/worded problems • Discussion • Failure okay – willing to take risks • Strategies – shows working out/communicates their approach to the problem
Persistent/resilient	• Targeted questions of each other and teacher • Failure but continuing to attempt the questions (okay to not understand at first/willingness to be unsure for a while) • Acceptance that the answer doesn't come easily
Confident to apply knowledge	• Take risks/willing to give a go and ask questions later • Share their knowledge – explain to others • Ability to attempt new knowledge by utlising previous knowledge

Developing a shared vision

Everyone can learn math to the highest levels

Mistakes are valuable

Questions are really important

Math is about creativity and making sense

Math is about connections and communicating

Math class is about learning not performing

Depth is more important than speed

Differentiation

MILD 🌶️	**Worksheet 270** Understanding - Qu 1 a, b, c, d
MEDIUM 🌶️🌶️	**Worksheet 270** Understanding - Qu 1 c, d Fluency - Qu 1
SPICY 🌶️🌶️🌶️	**Worksheet 270** Fluency - Qu 2 Problem solving - Qu 1
EXTRA SPICY 🌶️🌶️🌶️🌶️	**Worksheet 270** Reasoning - Qu 1, 2 **Outliers worksheet** Qu 1, 2

Getting There!	Questions 1, 4, 7, and 11
Working On It!	Questions 5, 9, 13 and15
Smashing It!	Questions 11, 14, 18, 19 and 20

Developing	Pythagoras Task
Consolidating	Trigonometry worksheet
Mastery	Trigonometry investigation

Student ownership of data

Maths Curriculum documentation

Year 7 Statistics

Victorian Curriculum Standards			
Level 5	**Level 6**	**Level 7**	**Level 8**
Pose questions and collect categorical or numerical data by observation or survey

Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies

Describe and interpret different data sets in context | Construct, interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables

Interpret secondary data presented in digital media and elsewhere

Pose and refine questions to collect categorical or numerical data by observation or survey | Identify and investigate issues involving numerical data collected from primary and secondary sources

Construct and compare a range of data displays including stem-and-leaf plots and dot plots

Calculate mean, median, mode and range for sets of data.

Interpret these statistics in the context of data

Describe and interpret data displays using median, mean and range | Distinguish between a population and a sample and investigate techniques for collecting data, including census, sampling and observation

Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes

Explore the variation of means and proportions of random samples drawn from the same population

Investigate the effect of individual data values including outliers, on the range, mean and median |

Vocabulary			
Measures of centre	Mean	Median	Mode
Measures of spread	Minimum	Maximum	Range
Frequency	Tally	Frequency tables	Frequency graphs
Class intervals	Column charts	Side-by-side column charts	Bar charts
Histograms	Dot plot	Stem-and-leaf plot	Back-to-back stem-and-leaf plot
Primary sources	Secondary sources	Sample	Population
Census	Survey	Observations	
Numerical data	Continuous data	Discrete data	
Categorical data	Ordinal data	Nominal data	

Maths Curriculum documentation

Lesson number and title	Learning Intentions	Motivate	Add	Practice	Success
1. **Getting started**	To understand what makes a positive Maths class. I can: 1. List what I need to bring 2. Explain what is expected of me 3. Identify ways I can contribute positively to group work and this class	https://www.transum.org/software/SW/Starter_of_the_day/students/hot/NineNineNine.asp Maths All About Me Maths All About Me.pdf (print)	*Intro PowerPoint* Set up workbooks Welcome to Year 7 PPWT Welcome to Year 7 Maths.pptx	*Four 4s* activity in groups Or *1- 100* Activity Paper chains (strengths I bring to a group. Each student writes 5 strengths on a strip of coloured paper. Groups join them to make a paper chain. Connect all groups together to represent class working together) Let's Make Squares.pdf	Five things that make a positive classroom
2. Pre assessment	To be able to demonstrate my prior understandings. I can: • Attempt all questions • Reflect on	What's going on in this graph? (notice and wonder) (Shows Northern Hemisphere data) https://www.nytimes.com/interactive/2018/05/03/learning/08WGOITGraphLN.html	Why do we do pretests? How can I improve my success on tests? (e.g. working out on paper, using a calculator but double checking result, asking teacher for clarification) Refer to Learning Trajectory and draw attention to goal-setting Hand out Essential Assessment login details and ask students to glue them	Essential Assessment pre-test: *Data Representation and Interpretation* Statistics and Probability Data Representation and Interpretation	==WTL: Exit slip== Goal-setting in evidence book

Early NAPLAN data

Year 9 Numeracy
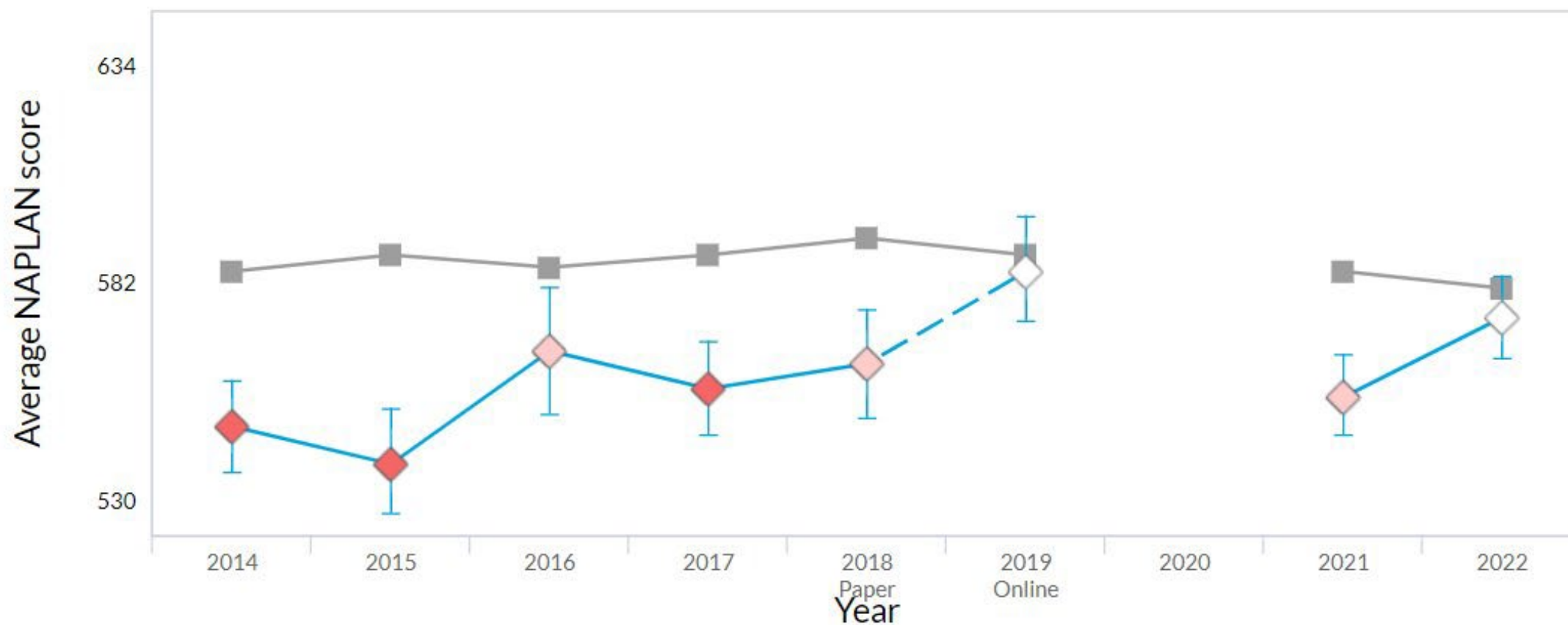
Stage 2: Whole school focus

To empower all teachers
to be teachers of
Numeracy

Stage 2: Whole school focus

Numeracy across the curriculum

Making connections

Multiple exposures

Professional Learning focus

Developing positive mindsets

Having fun!

Gathering support

Building teacher confidence

Providing time to make gradual change

Developing positive mindsets

Unpacking teachers' experiences and perceptions

More		Less	
Worded questions	1	Time teaching to the 'smart' kids	1
Real life problems	1	Repetition of topics year to year	1
Examples	1	Expectation there is only one way to do things	1
Connections between subjects	1	Stereotype about Maths	1
Extension	1	Negativity	1
Celebration of achievements	1	Traditional bookwork	1
Time to work things out	1	Labelling self as 'not a Maths person'	1
Group work	2	One size fits all' explanations	1
Differenting between maths and numeracy	2	Abstract explanations	1
Support	2	Conceptual processes without real applications	1
Interactive (authentic) activities	2	Pointless work'	1
Varied ways of explaining methods	3	Belligerant teachers	1
One on one help scaffolded to students' needs	3	Discussion on what you could do if Maths not your strength	1
Real life skills and applications	3	Being labelled for needing extra support	2
Connections to real life applications	19	Text book	7

Developing positive mindsets

1. Everyone can learn math to the highest levels.

Encourage students to believe in themselves. There are different parts to this – first we need students to know that they can achieve at any math level, and there is no such thing as a math person. Brain information is really good for this.

Second we need them to have a "growth mindset" – believing that they can learn anything, and the more work they do the smarter they will get.

An important way to encourage a growth mindset is by praising what students have done and learned, not them as a person. So instead of saying "you are so smart", say "it is great that you have learned that."

Some videos you might want to share with students to encourage positive brain messages and a growth mindset:

What is a growth mindset?

There is a really damaging myth that pervades the US/ UK and other countries – the idea that some people are born with a "math brain" and some are not. This has been resoundingly disproved by research but

2. Mistakes are valuable

Tell students that you love mistakes and that they will be valued at all times, tell them that it is good to make mistakes as we know that when people make mistakes, their brains are growing. This single message can be incredibly liberating for students. Here are some suggestions for encouraging positive thinking about mistakes:

1. Ask students with mistakes to present mistakes (especially deep, conceptual ones) on the board so that everyone can learn from them. If one student makes a conceptual mistake, there are probably many others making the same one.

2. When students get something wrong – instead of being discouraging or sympathetic, say "your brain just grew! Synapses are firing, that's really good"

Research shows that when students make mistakes, synapses fire and brains grow. Brain activity is particularly strong in individuals with a growth mindset. It is good to make mistakes.

Activity 3 from Kim Hollowell at Vista Unified. You can get the brain template at http://youcubed.org/teachers/wp-content/uploads/2014/08/Kims-Brain.pdf

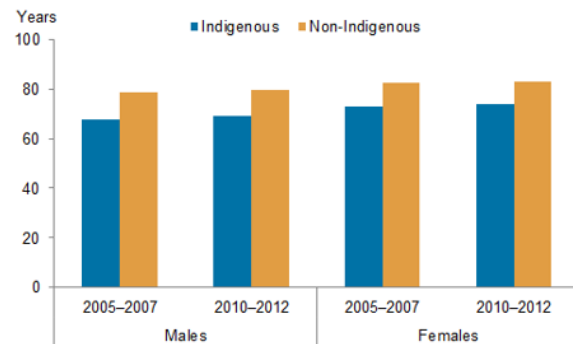# Professional learning – having fun!
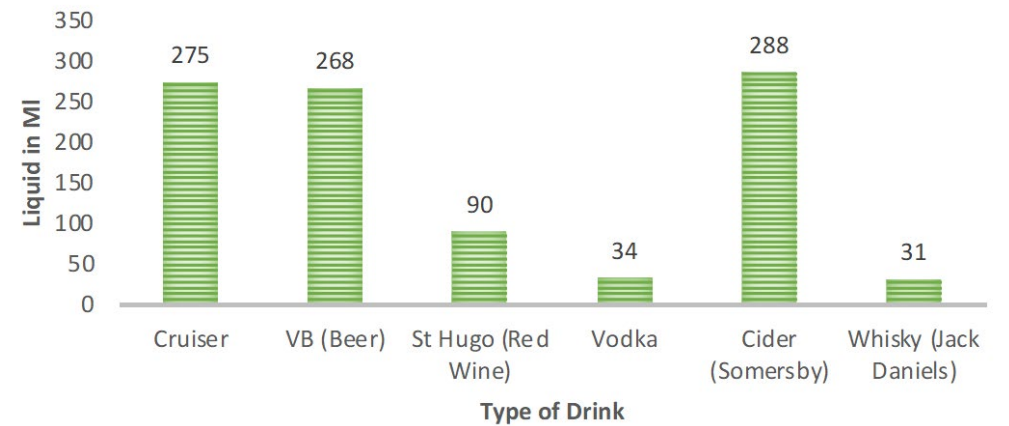
Having fun!

Gathering support

Indigenous Australians vs Non-Indigenous Australians Health

Life expectancy at birth, by sex and Indigenous status, 2005–2007 and 2010–2012
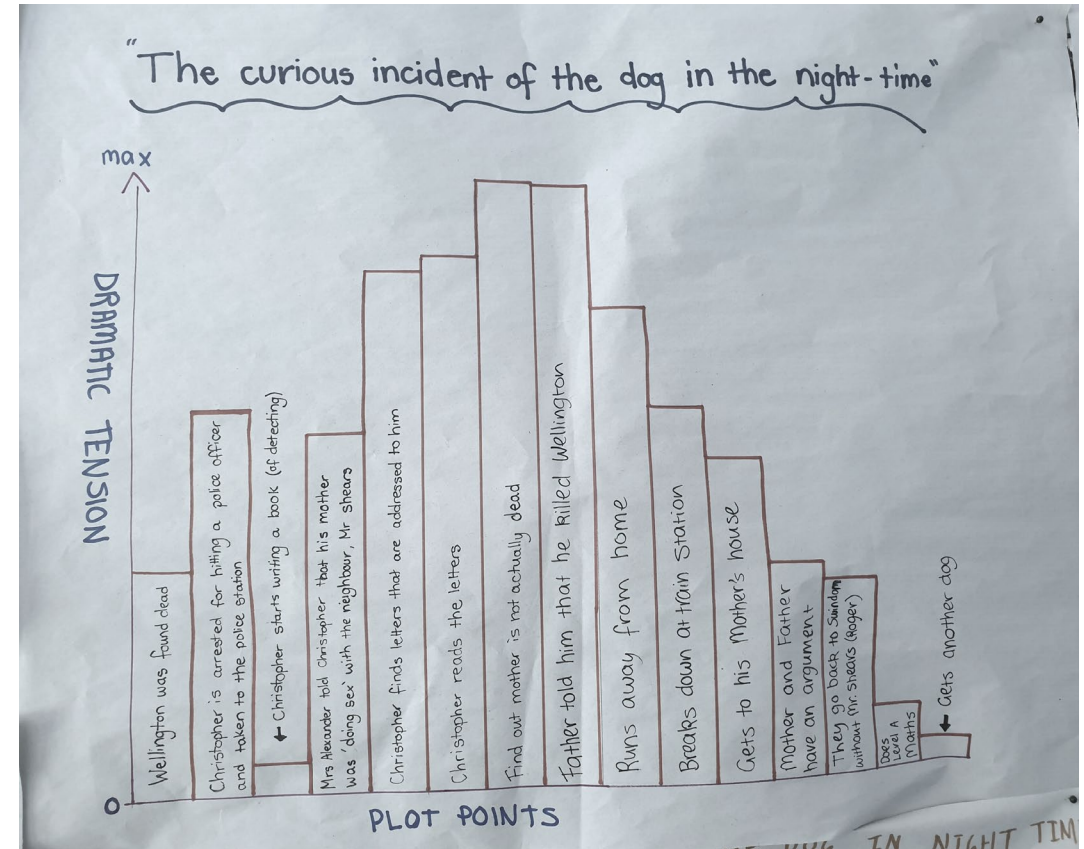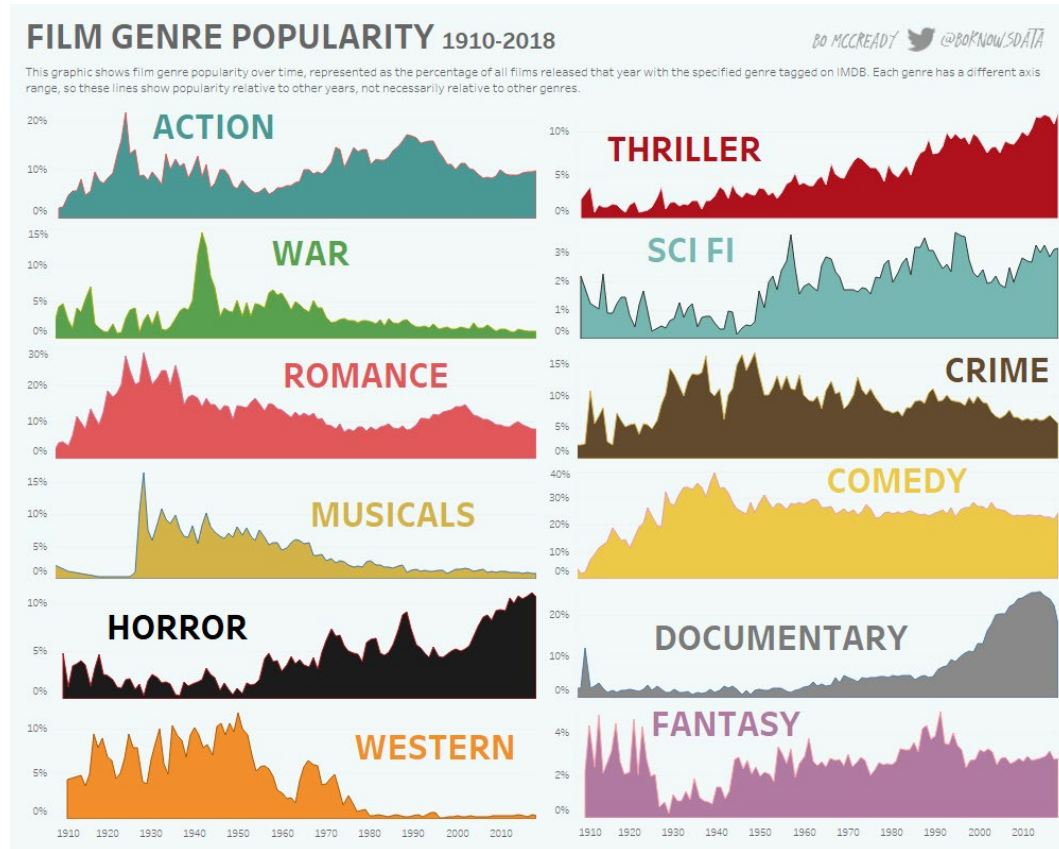
Complete a notice and wonder for the graph shown

MILLILITRES IN A STANDARD DRINK:

Gathering support

Gathering support

Numeracy in Design

Lesson Activities

Mixing Colours

Visual Entry Point:

The idea for this activity was to mix food colouring in to clear plastic cups labeled **C (cyan)**, **M (magenta), Y (yellow), and K (black)** to represent ink from a printer.

I also got students to predict what the colours would make when I mixed them. I finished off with what would happen when I mixed all the colours together at the end of the activity.

I felt it was important for students to visualise a demonstration of how a percentage of colour can impact the overall look of a colour when it was mixed.

Numeracy in Design

Lesson Activities

Ink 'N' Match

Group Work:

After the students observed the mixing of liquids, students were handed a card with either a CMYK percentage or a colour.

Their objective was to find another student that had either the colour or percentage that matched their card.

Ink 'N' Match

C = 0
M = 100
Y = 0
K = 0

Ink 'N' Match

C = 100
M = 0
Y = 0
K = 0

C = 75
M = 5
Y = 100
K = 0

Ink 'N' Match

Ink 'N' Match

Building teacher confidence

Skill-building sessions

Supporting implementation: Year 9 Photography

Developing film using ratios

When mixing chemicals to develop film, we need to measure the chemicals by the correct ratios.

If we don't use the correct ratios, our photos will not turn out correctly.

Supporting implementation: Year 9 Visual Art

Supporting implementation: Year 10 English

Oklahoma Crime Rates

The following website provides data relating to crime rates in Oklahoma from 1960 through to 2019.
https://www.disastercenter.com/crime/okcrimn.htm

At the top of the page we can see the total number of crimes committed.

Oklahoma Population and Number of Crimes 1960 - 2019
Oklahoma

Year	Population	Index	Violent	Property	Murder	Forcible Rape	Robbery	Aggravated assault	Burglary	Larceny-Theft	Vehicle Theft
1960	2,328,284	46,923	2,258	44,665	174	299	929	856	12,834	27,270	4,561
1961	2,360,000	46,029	2,437	43,592	119	286	817	1,215	12,586	26,513	4,493
1962	2,448,000	48,437	2,478	45,959	126	182	973	1,197	12,563	28,501	4,895
1963	2,487,000	48,816	2,808	46,008	129	200	997	1,482	13,331	27,904	4,773

If we scroll down the page we can see the number of crimes per 100,000 people. This data is more useful to use as it give us an indication of the proportion of the population committing crimes, taking into account the fact that the total population has increased significantly from 1960 to 2019.

Oklahoma Population and Rate of Crime per 100,000 People 1960 - 2019

Year	Population	Index	Violent	Property	Murder	Forcible Rape	Robbery	Aggravated assault	Burglary	Larceny-Theft	Vehicle Theft
1960	2,328,284	2,015.3	97.0	1,918.4	7.5	12.8	39.9	36.8	551.2	1,171.2	195.9
1961	2,360,000	1,950.4	103.3	1,847.1	5.0	12.1	34.6	51.5	533.3	1,123.4	190.4
1962	2,448,000	1,978.6	101.2	1,877.4	5.1	7.4	39.7	48.9	513.2	1,164.3	200.0
1963	2,487,000	1,962.8	112.9	1,849.9	5.2	8.0	40.1	59.6	536.0	1,122.0	191.9

Your Task
1. You will be allocated a time period between 1960 - 2019 and one type of crime to investigate in that period.
2. Take a screenshot of the data for that time period, using data from the **'Crimes per 100,000 People'** category.
3. Enter your data in Excel.
3. Graph your data using a **line graph**. Label it with a **title** and **axis labels**.
4. Write two comments to show what you **notice** about the data.
5. Write one comment to show what you **wonder** about the data.

Supporting implementation: Year 10 Physical Education

Calculating 1 Rep Max

Middle School Peak Power

Here is a process that will work every time...

Step 1
Identify your number

Step 2
Identify the percentage needed

Step 3
Convert your percentage to a decimal by dividing by 100

Step 4
Multiply the decimal by your starting number

Step 1
150

Step 2
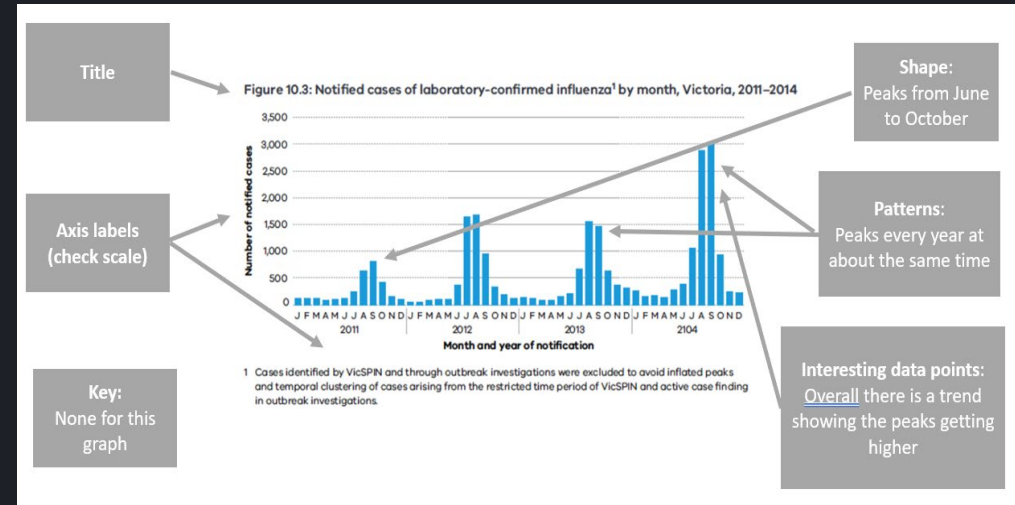85%

Step 3
85 ÷ 100 = 0.85

Step 4
0.85 x 150 = 127.5

So, 85% of 150 is 127.5

Supporting implementation: Year 11 Health & Human Development

Title

Axis labels (check scale)

Key: None for this graph

Figure 10.3: Notified cases of laboratory-confirmed influenza¹ by month, Victoria, 2011–2014

Shape: Peaks from June to October

Patterns: Peaks every year at about the same time

Interesting data points: Overall there is a trend showing the peaks getting higher

1 Cases identified by VicSPIN and through outbreak investigations were excluded to avoid inflated peaks and temporal clustering of cases arising from the restricted time period of VicSPIN and active case finding in outbreak investigations.

Putting Comments Together

This graph shows the number of notified cases of laboratory-confirmed cases of influenza in Victoria from 2011 to 2014. Each year, there is a spike in confirmed cases, which begins in June and lasts until October. The number of infected cases during each year's spike has also increased each year. In 2011, the peak number of infected cases was around 800 while in 2014, the peak number increased to just over 3000.

Figure 10.3: Notified cases of laboratory-confirmed influenza¹ by month, Victoria, 2011–2014
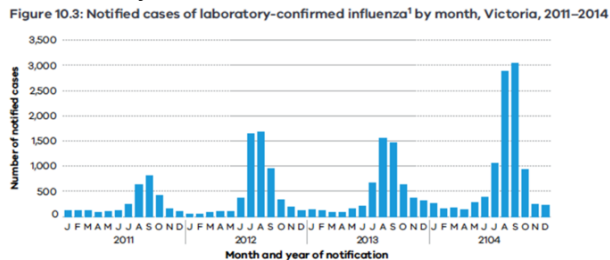
Professional learning: Structured and scaffolded

Arts						
				Elements of numeracy as a general capability		
Year Level	Subject	Topic	Calculating and estimating	Recognising and using patterns and relationships	Fractions, decimals, percentages, ratios and rates	Spatial reasoning
Year 7	Media				of photographs.	the rules of odd and even and symmetrical and asemetical composition for
Year 12	Media	Agency and Control in and of the Media	Estimating media usage rates among different demographics	Looking at data for trends - e.g. change in road fatalities between 1989 and 2019	Working with percetanges of audience share, media usage, research results	
Year 7	Art	Photograms	Calculating and estimating how long to leave an artwork in the chemicals	Identifying patterns in artworks and creating patterns and relationships between objects in their own photograms.	Using ratios to understand chemicals used calculating gallery commissions	Ensuring the environment is safe, spoacitius and airated to work in the darkroom.
Year 9-10	VCD	Ink Percentage	Estimating colour from percentages of CMYK ink		Calculating percentage and/or colour through groupwork	
Year 9-10	Media	Radio/Podcasting	Constructing run sheets by calculating time for each segment. Calculating equipment budgets.		Using percentages and rates to calculate advertising revenue.	

Victorian Academy of Teaching and Leadership

Now

Then,
Now,
Next

LILYDALE HEIGHTS
COLLEGE

Now

> Cultural shift towards Numeracy

> Increased consistency and rigour with a focus on growth

> Increased use of data across the college

> Increased Numeracy encounters and connections

> Numeracy documentation in all unit plans

Victorian Academy
of Teaching and Leadership

Growth focus and rigour

Grading

Learning Growth

Progressed from Level 6 to 7

Performance

At the expected level

Growth focus and rigour

	A1: Recognising and recording number patterns	A3: Manipulating algebraic equations	A4: Solving algebra / A6: Graphing equations
7	I can substitute values into formulas to determine an unknown (VC2M7A01)		I can generate a table of values from a number rule (VC2M7A05)
	I can enter missing numbers from a table of values, following a rule (VCM7A05)		I can generate tables of values from visually changing patterns (VC2M7A05)
	I can create an expression that represents a worded mathematical relationship (e.g. think of a number) (VC2M7A02)	I can identify and group like terms (VC2M7A02)	I can solve one- and two-step equations showing each step used in the process (VC2M7A03)
	I can generate a table of values from a number rule (VC2M7A05)	I can use index notation to simplify algebraic expressions (e.g. mxmxm=m³) (VC2M7A02)	I can solve two-step equations, and check for accuracy using substitution (VC2M7A03)
	I can generate tables of values from visually changing patterns (VC2M7A05)	I can simplify expressions using algebraic notation (e.g. 2xg=2g, a+a+a=3a) (VC2M7A02)	I can solve one-step equations, checking for accuracy using substitution (VC2M7A03)
6	I can design my own pattern, record it in an input/output table and explain patterns that emerge. (VC2M6A03)		
	I can write number sentences to match worded problems. (LHC)		I can read and interpret a graph in a real-world context (LHC - VC2M7A04)
	I can identify and explain a pattern created by a rule in an input/output table. (VC2M6A03)		I can apply the order of operations (BODMAS) to solve numerical equations (VC2M6A02)
	I can create a visual pattern sequence and write a rule which represents the pattern. (VC2M6A01)	I can show and prove that indices are used to show repeated multiplication (e.g. 5x5x5x5=5⁴) (LHC - VC2M7A02)	I can find and compare unknown values in numerical equations with and without brackets (VC2M6A02)
	I can create, describe, and continue a number pattern using multiplication or division (VC2M6A01)	I can show and prove that multiplication is used to show repeated addition (e.g. 2+2+2=3x2) (LHC - VC2M7A02)	
5	I can create, describe and continue a number pattern using addition or subtraction (LHC)		
	I can identify and continue a number pattern (LHC)		I can explain and show the connection between multiplication and division as inverse operations (VC2M5A01)
	I can identify and continue a visual pattern (LHC)		I can find unknown values in numerical equations involving multiplication and division using mental strategies (VC2M5A02)
4	I can apply related multiplication and division facts up to 10x10 to develop strategies for computation with larger numbers, without a calculator (VC2M4A02)		I can find unknown values in numerical equations involving addition and subtraction (VC2M4A01)
	A1: Recognising and recording number patterns	**A3: Manipulating algebraic equations**	**A4: Solving algebra / A6: Graphing equations**

Increased use of data

Accessing, interpreting and analysing PAT Maths data
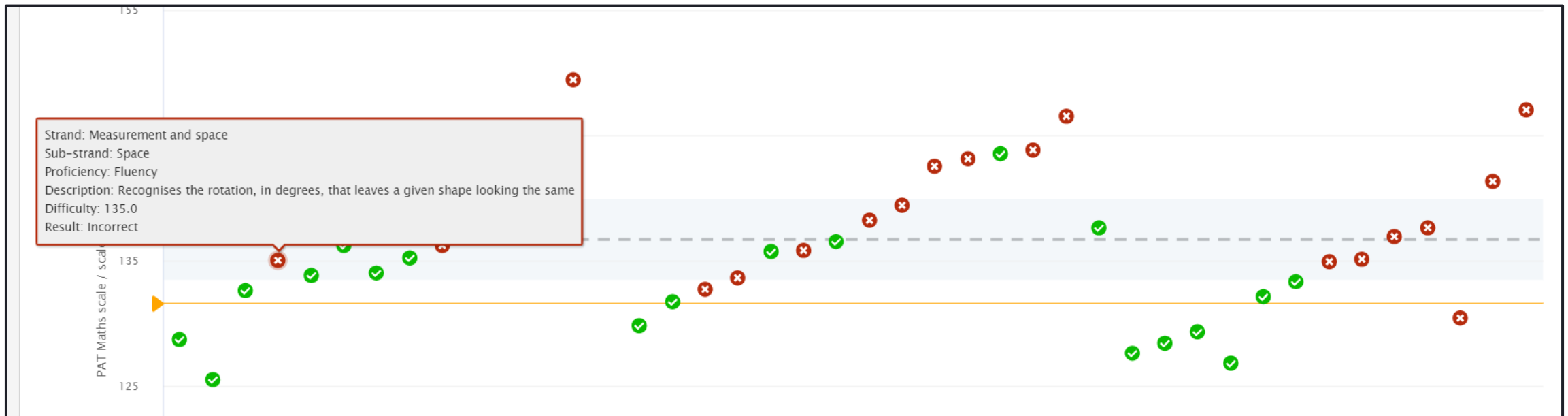
Curriculum documentation

I'm Not Racist, But… (Humanities) Unit Plan

Lesson 1:	Lesson 1:	Lesson 1: Blackbirding
To understand the history of South Sea Islander peoples	I can create a resource to educate others I can discuss the atrocities of blackbirding I can collaborate with my peers	**M:** LITERACY WTL - based on Scott Morrison's comments about Australia's history of slavery - https://youtu.be/XWNz2mPLSMo **A:** The history of South Sea Islanders Brief analysis of statistics from 1847 – 1908 NUMERACY **P:** PT: Infographic – in pairs, students create an infographic used to educate others on South Sea Islander history. **S:** Gallery Walk – students do a gallery walk and leave one sticky note piece of feedback for one student
Lesson 2:		

2023 VCE data

37+ scoring students in 2023 (%) ⓘ

For students in **All year levels, Mathematics :Further Mathematics**

18%	**7%**	**9%**	**15%**
Your school	Similar schools	Network	State

Students by score group over last 5 years (%) ⓘ

For students in **All year levels, Mathematics: Further Mathematics**

Legend:
- 37 +
- 29 - 36
- 20 - 28
- < 20

	2019	2020	2021	2022	2023
37 +					18%
29 - 36	21%	26%	23%	32%	32%
20 - 28	21%	47%	36%	50%	36%
< 20	57%	26%	41%	14%	14%
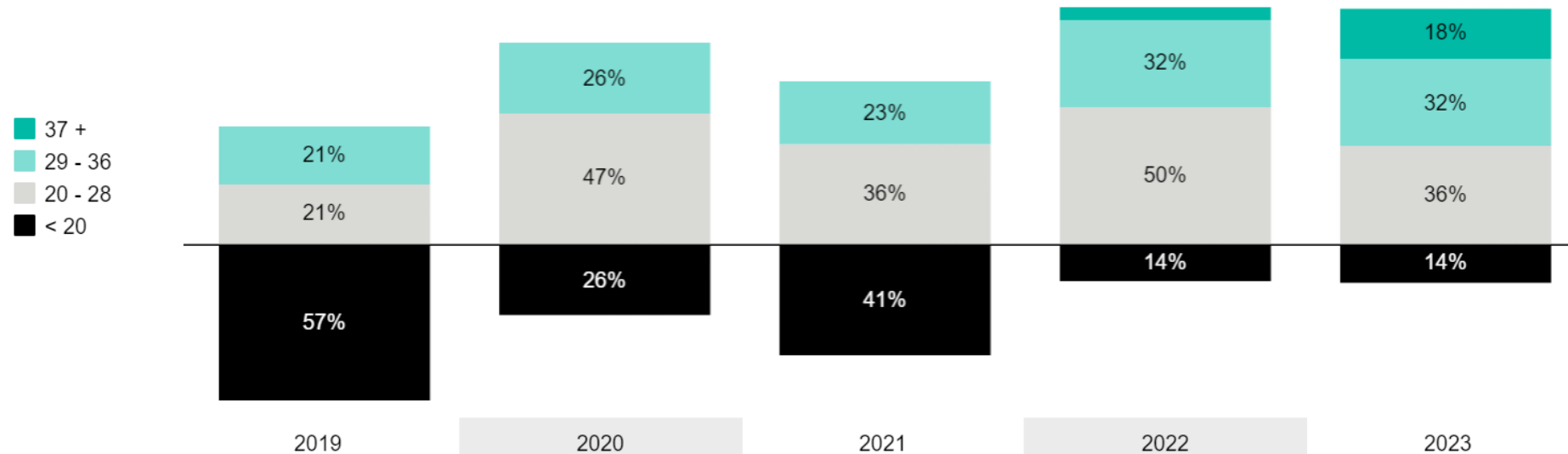
Recent Numeracy data

NAPLAN 2024: Year 9 Exceeding & Strong

Lilydale Heights College	Similar Schools	Network
62%	54%	56%

Next steps

Our upcoming focus areas include:

Strengthening numeracy encounters across all classrooms

Supporting teachers to access and analyse data and evidence

Refining 'point of need' teaching and developmental assessment

Developing the next 5-year plan

Your turn:
Numeracy improvement planning

Use the Lilydale Heights College (LHC) Numeracy plan to consider the following:

> What are your next steps in Numeracy improvement at your school?

> What strategies are you currently **consolidating** or **embedding**?

> What strategies would you like to **introduce**?

> How might this model be helpful in leading change at your school?

LILYDALE HEIGHTS COLLEGE NUMERACY PLAN 2018-2022

Victorian Academy of Teaching and Leadership

Thankyou

Lilydale Heights College