CURRICULUM, PEDAGOGY AND BEYOND

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B15 – Effective and Efficient Numeracy Pedagogy through Connected Curriculum

Gloria Yi, St Albans Secondary College
Milton Bai, Kensington Community High School

Gloria Yi: presenter

P-12 Teacher

Master of Teaching (Primary) & Master of Teaching (Secondary), the University of Melbourne

Portland Secondary College: mathematics teacher, recipient of Department of Education TFI program

St Albans Secondary College: mathematics teacher (Maths Leader), Staff Development (VIT full registration, pre-service teacher placements)

Milton Bai: co-presenter

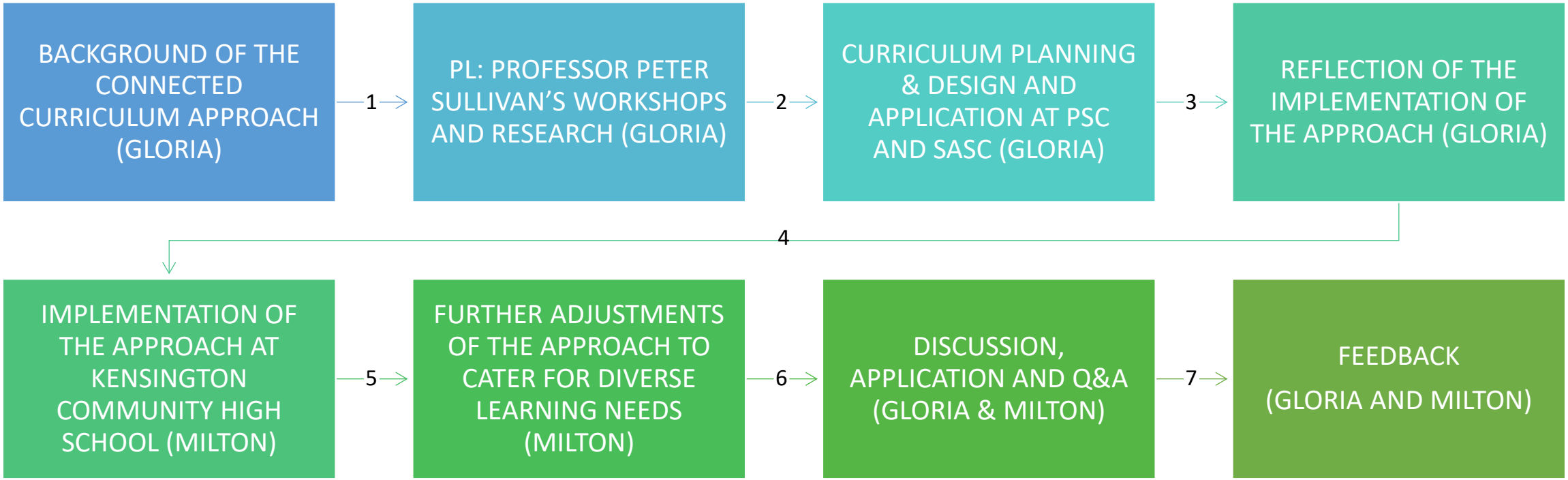
Secondary School Teacher

Master of Teaching (Secondary), Monash University & Master of Education, the University of Melbourne

Brauer College (Warrnambool): mathematics teacher

Kensington Community High School: mathematics teacher, placement coordinator

Outline of the Session



Background of the connected curriculum approach

2021-2022 at Portland Secondary College

Numeracy learning needs identified by student data (NAPLAN, PAT-M, etc.)

School AIP created aiming at improving Yr7 Numeracy

Student agency: feedback from students showed the need of improving numeracy engagement

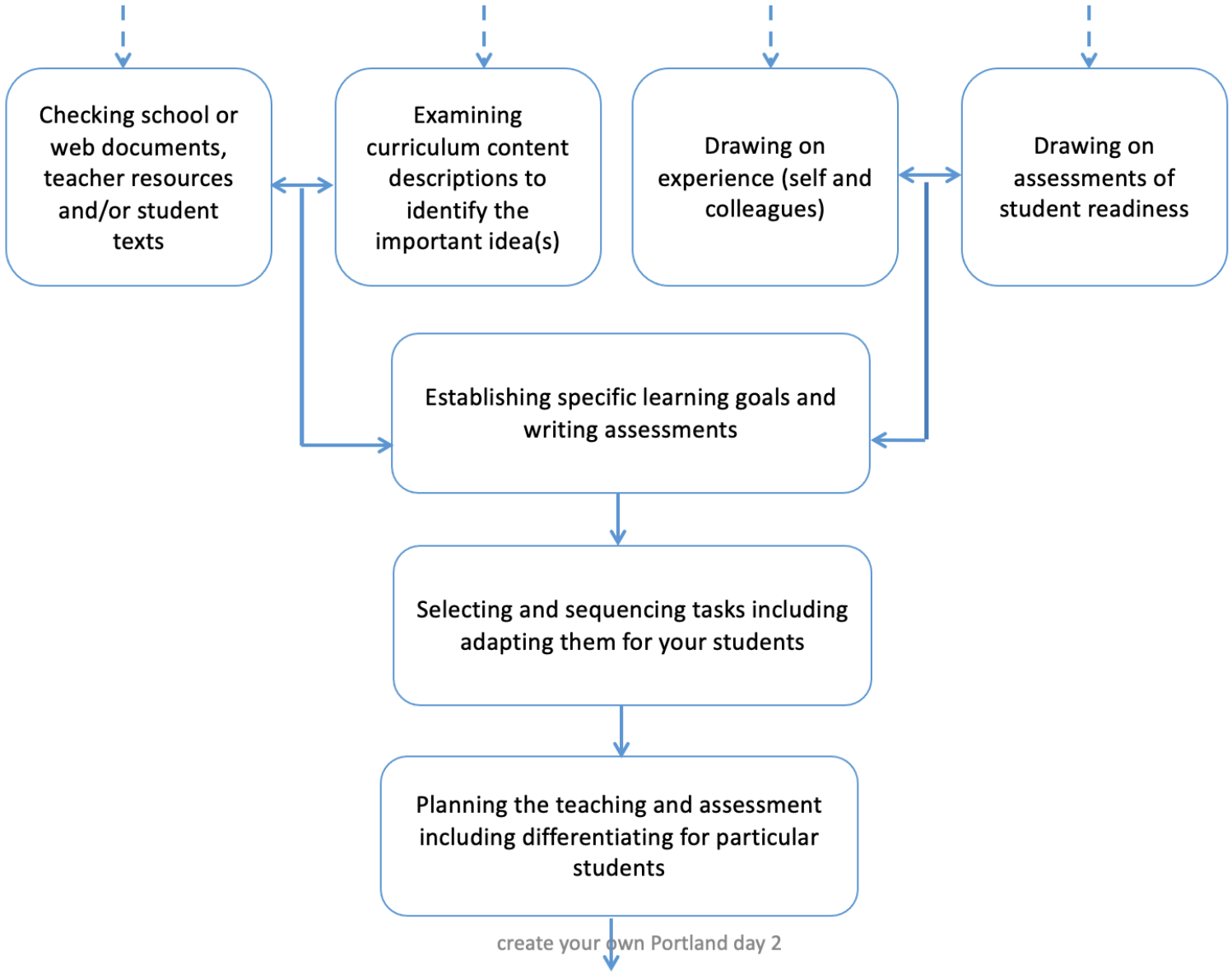
PL:
Professor Peter Sullivan's workshops and research

As a Yr7 Mathematics team we researched Professor Peter Sullivan's 3 levels of complexity (fluency, problem-solving and reasoning)

Network of Portland (and surrounding areas such as Hamilton) Primary & Secondary Government Schools invited Professor Peter Sullivan to Portland for two whole-day workshops

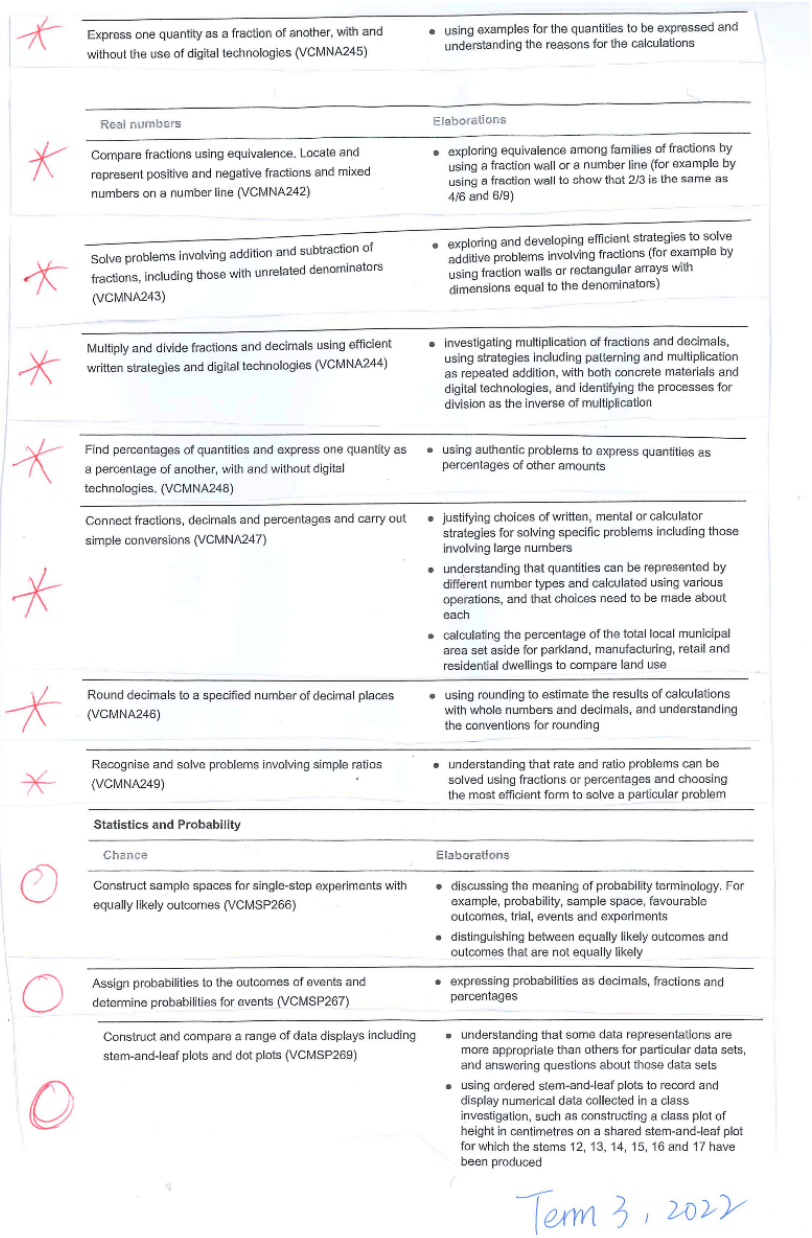
PL:

Professor Peter Sullivan's workshops and research



Curriculum planning at

Portland Secondary College



Express one quantity as a fraction of another, with and without the use of digital technologies (VCMNA245)	• using examples for the quantities to be expressed and understanding the reasons for the calculations
Real numbers	**Elaborations**
Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line (VCMNA242)	• exploring equivalence among families of fractions by using a fraction wall or a number line (for example by using a fraction wall to show that 2/3 is the same as 4/6 and 6/9)
Solve problems involving addition and subtraction of fractions, including those with unrelated denominators (VCMNA243)	• exploring and developing efficient strategies to solve additive problems involving fractions (for example by using fraction walls or rectangular arrays with dimensions equal to the denominators)
Multiply and divide fractions and decimals using efficient written strategies and digital technologies (VCMNA244)	• investigating multiplication of fractions and decimals, using strategies including patterning and multiplication as repeated addition, with both concrete materials and digital technologies, and identifying the processes for division as the inverse of multiplication
Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. (VCMNA248)	• using authentic problems to express quantities as percentages of other amounts
Connect fractions, decimals and percentages and carry out simple conversions (VCMNA247)	• justifying choices of written, mental or calculator strategies for solving specific problems including those involving large numbers • understanding that quantities can be represented by different number types and calculated using various operations, and that choices need to be made about each • calculating the percentage of the total local municipal area set aside for parkland, manufacturing, retail and residential dwellings to compare land use
Round decimals to a specified number of decimal places (VCMNA246)	• using rounding to estimate the results of calculations with whole numbers and decimals, and understanding the conventions for rounding
Recognise and solve problems involving simple ratios (VCMNA249)	• understanding that rate and ratio problems can be solved using fractions or percentages and choosing the most efficient form to solve a particular problem
Statistics and Probability	
Chance	**Elaborations**
Construct sample spaces for single-step experiments with equally likely outcomes (VCMSP266)	• discussing the meaning of probability terminology. For example, probability, sample space, favourable outcomes, trial, events and experiments • distinguishing between equally likely outcomes and outcomes that are not equally likely
Assign probabilities to the outcomes of events and determine probabilities for events (VCMSP267)	• expressing probabilities as decimals, fractions and percentages
Construct and compare a range of data displays including stem-and-leaf plots and dot plots (VCMSP269)	• understanding that some data representations are more appropriate than others for particular data sets, and answering questions about those data sets • using ordered stem-and-leaf plots to record and display numerical data collected in a class investigation, such as constructing a class plot of height in centimetres on a shared stem-and-leaf plot for which the stems 12, 13, 14, 15, 16 and 17 have been produced

Term 3, 2022

Design and application of assessment:

CAT

Design and application of summative assessment: CAT Rubric

Yr7 Portland Music Festival Connected Curriculum CAT Rubric

Strand	Emerging skills (VL)	Working towards the level (L)	At the level 1st complexity (M)	At the level 2nd complexity (H)	At the level 3rd complexity (VH)
Number & Algebra	You have provided your teacher with evidence that you have completed some set classwork leading up to the CAT that you have some basic awareness and ability to work with the content	You have provided your teacher with evidence that you have completed most set classwork leading up to the CAT and that you have demonstrated some understanding and ability to work with the assessed skills. You have attempted the Understanding and Fluency component of the CAT, however, there are **several inaccuracies in your responses and/or some of your responses are incomplete, too brief and/or you may have completed it with guidance**.	You have completed the Understanding and Fluency components of the CAT to a satisfactory standard and have demonstrated a satisfactory *understanding* and ability to work with assessed skills.	You have completed the Problem-solving component of the CAT to a satisfactory standard and have demonstrated a satisfactory understanding and ability to *problem solve* with the assessed skills.	You have completed the Reasoning component of the CAT to a satisfactory standard and have demonstrated a satisfactory ability to work and *reason* with the assessed skills.
			For the Number and Algebra Strand, you can: • Connect fractions, decimals and percentages and carry out simple conversions – Q1 (246, 247) • Compare equivalent fractions, decimals, or percentages to identify the greatest value – Q2 (242) • Make simple decisions based on fractions comparison – Q3 (242) • Recognise and solve problems involving simple ratios – Q7 (243, 244) • Express one quantity as a fraction of another – Q9, Q19 (245) • Find percentage quantities and express one quantity as a percentage of another – Q17 (248) • Express one quantity as a fraction of another and connect it to the equivalence decimal – Q20 (245, 246, 247)	• Recognise and solve problems involving simple ratios – Q4 (249) • Solve problems by converting and comparing fractions, decimals, or percentages – Q5 (247, 242) • Conduct multiplications that involves ratios using efficient written strategies and digital technology – Q8 (243, 244) • Express one quantity as a fraction of another, and simplify – Q9, Q19 (245)	• Explain decision-making through comparing fractions using equivalence – Q3 (242) • Make predictions based on calculations that involve multiplication and division of fractions and decimals – Q6 (244)
Statistics & Probability			**For the Statistics and Probability Strand, you can:** • Assign probabilities to the outcomes of events and determine probabilities for events – Q10 (267) • Create sample space for single-step experiments with equally likely outcomes – Q13 (266) • Provide a simple yes/no judgements of the given likelihood statement – Q14 (267) • Construct and compare a range of data displays including stem-and-leaf plots and dot plots – Q15 (269) • Abstract simple information from statistical graphs – Q16 (269)	• Gather information from a given real-life scenario and summarise probabilities of events through a table – Q11 (267) • Abstract and analyse process information from statistical graphs – Q16 (269) • Calculate and determine probabilities of events for a given real life scenario – Q18 (267)	• Investigate probabilities of a series of real-life events, conduct decision-making and justify – Q12 (267) • Explain and justify judgements made on the given likelihood statement – Q14 (267) • Abstract information, mathematically process and analyse to produce complex information from statistical graphs – Q16 (269)

Note: codes after each question number (e.g., 245, 242, 269, etc.) represent the matching VicCurric descriptors (e.g., VCMNA245, VCMNA242, VCMSP269, etc.)

Implementation at St Albans Secondary College: Assessment

Year 10 Applied Mathematics Class (pre VM-Numeracy)

Poster: Canva (https://www.canva.com/)

Cohort:
ZAD Lv7/8 or below
Modified learners
Disengaged learners
Special needs learners


Group discussion: what do you think?

3 levels of complexity

Part 3 – AFTER THE FESTIVAL

USE THIS INFORMATION TO ANSWER **QUESTIONS 13 & 14**

At the end of the festival, a group festival goers were surveyed about their experience at the festival.

This Stem and Leaf Plot below shows the ages of the festival goers who were surveyed.

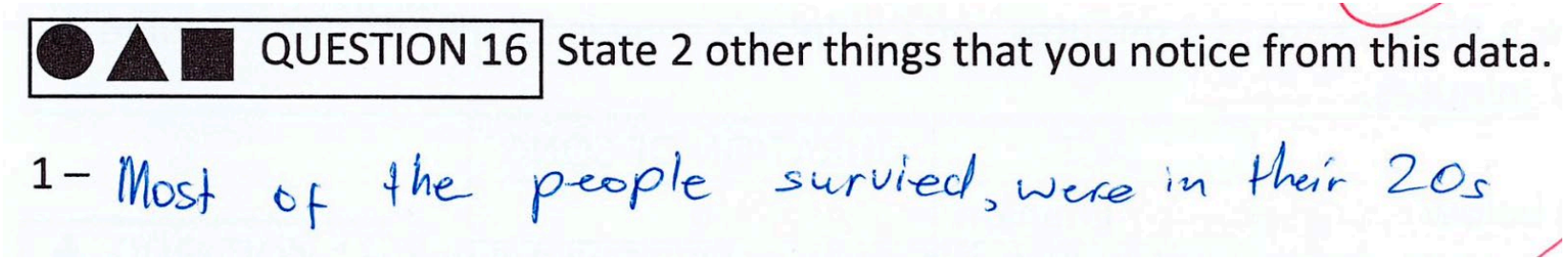
STEM	LEAF	key: 5|4=54
1	2 3 3 4 4 4 6 7 7 9	
2	0 0 1 3 4 4 4 5 8 8 8 8 9 9	
3	1 1 3 5 6 6 6 8 9 9 9	
4	4 5 5 6 8 8 8	
5	4 5 7 7 9	
6	1 1 4	
7	0 3 8 8 9	
8	8	

QUESTION 16 State 2 other things that you notice from this data.

Sample Student Responses

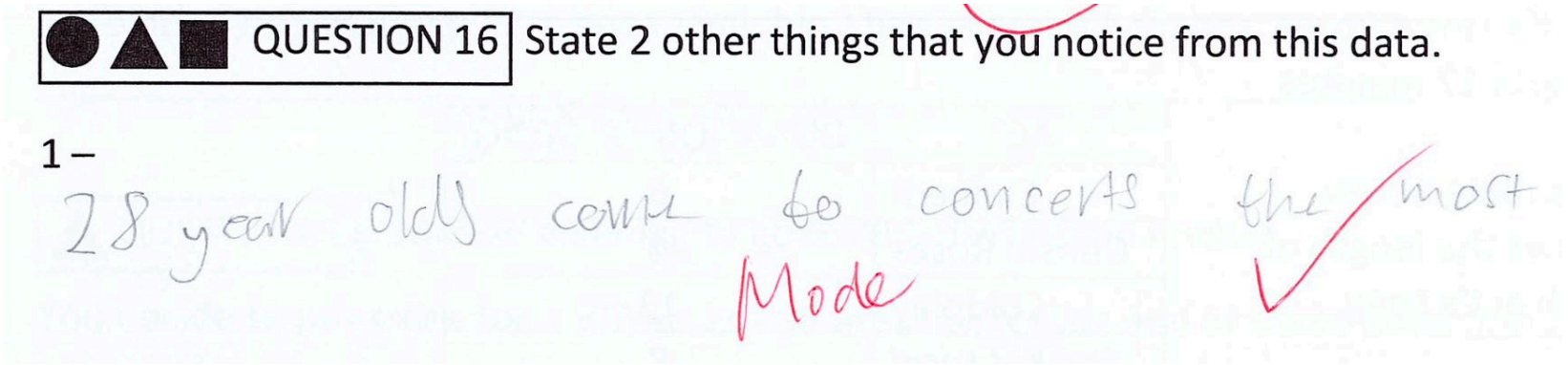
1st level of complexity – fluency	• "5 people who went to the festival aged between 50 and 59"
2nd level of complexity – problem-solving	• "Most of the people who went to the festival aged between 20 and 29"
3rd level of complexity – reasoning	• "Organizers of the festival should invite singers and bands that can attract more people aged 60 or above because those age levels have the lowest numbers of attendees"

SASC Student Responses


QUESTION 16 State 2 other things that you notice from this data.

1- Most of the people survied, were in their 20s

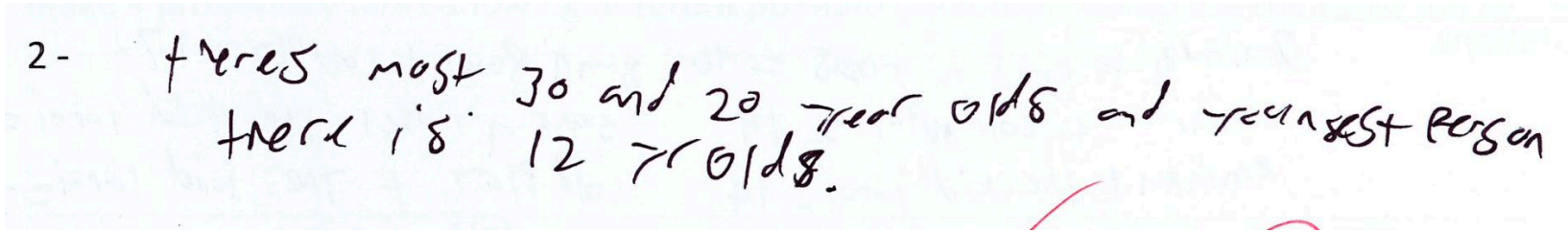
2nd Level of complexity


QUESTION 16 State 2 other things that you notice from this data.

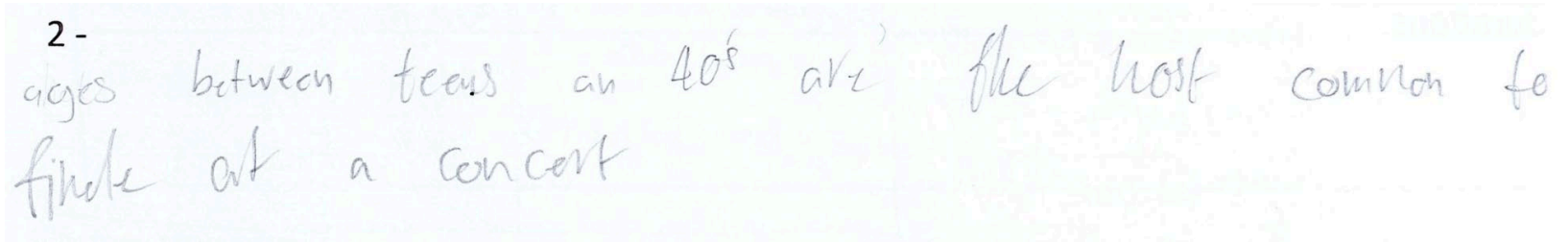
1-
28 year olds come to concerts the most
Mode

2nd Level of complexity

SASC Student Responses

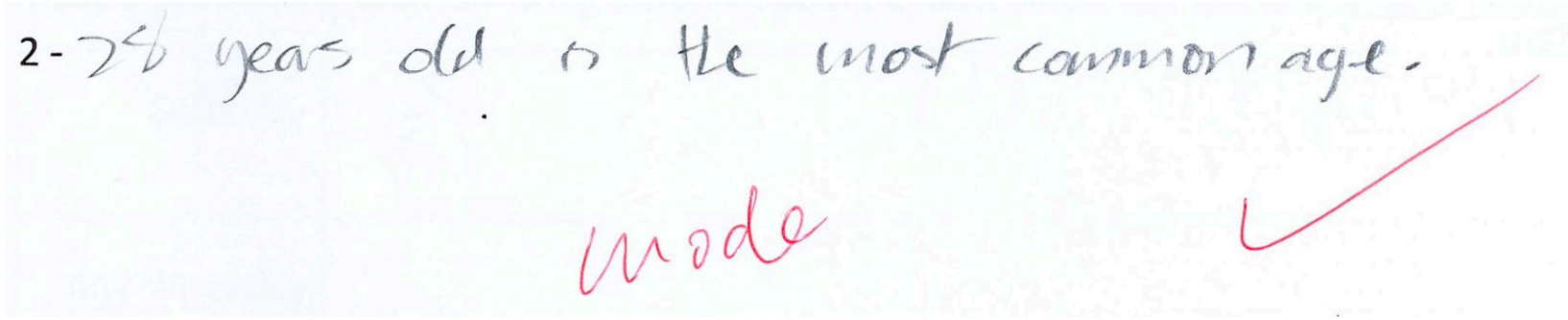


1st and 2nd Level of complexity

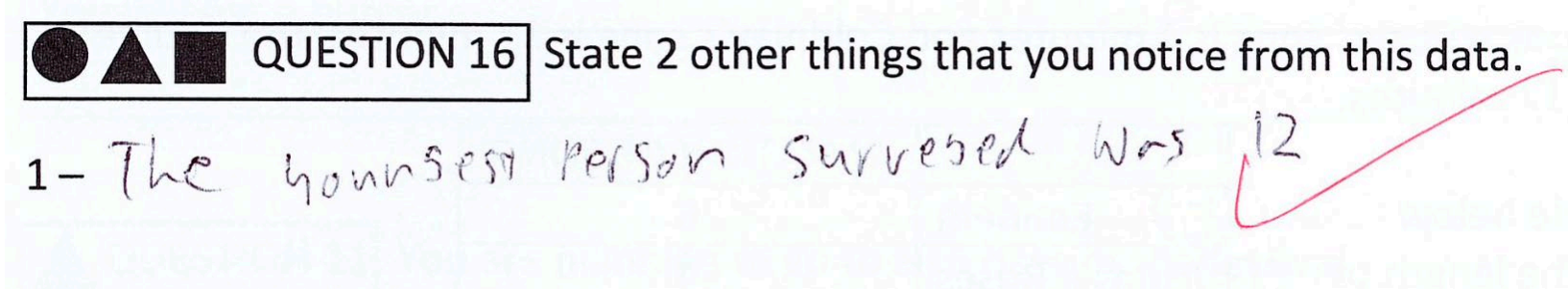


3rd Level of complexity

SASC Student Responses

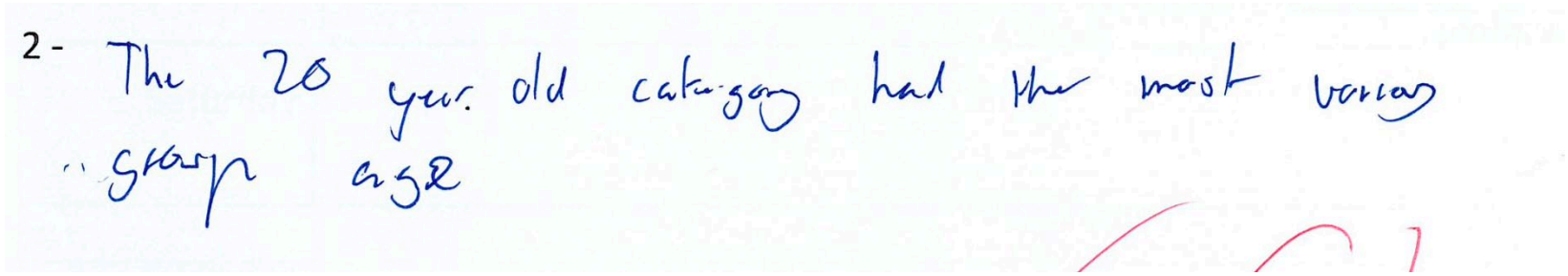


2nd Level of complexity

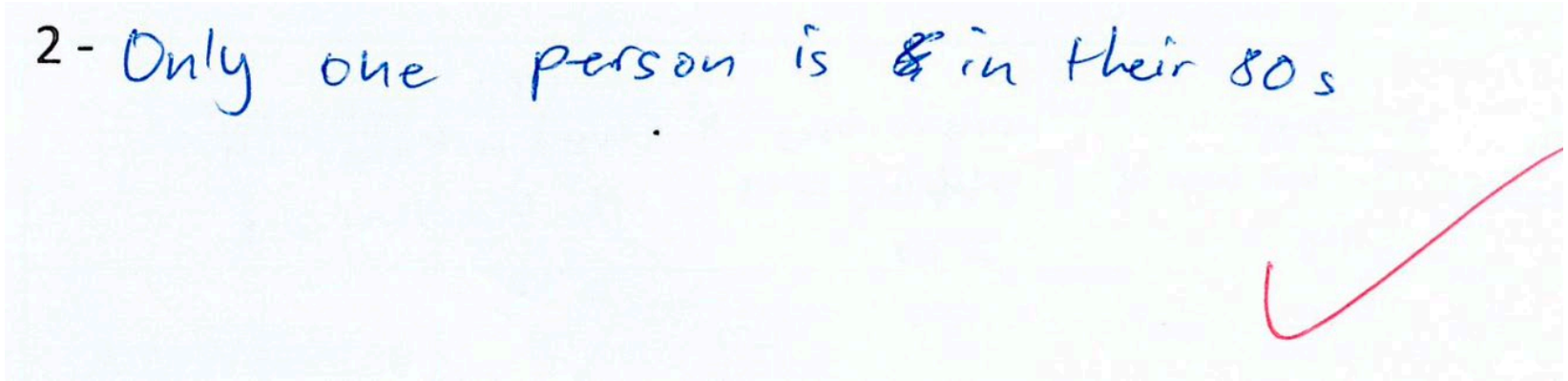


1st Level of complexity

SASC Student Responses

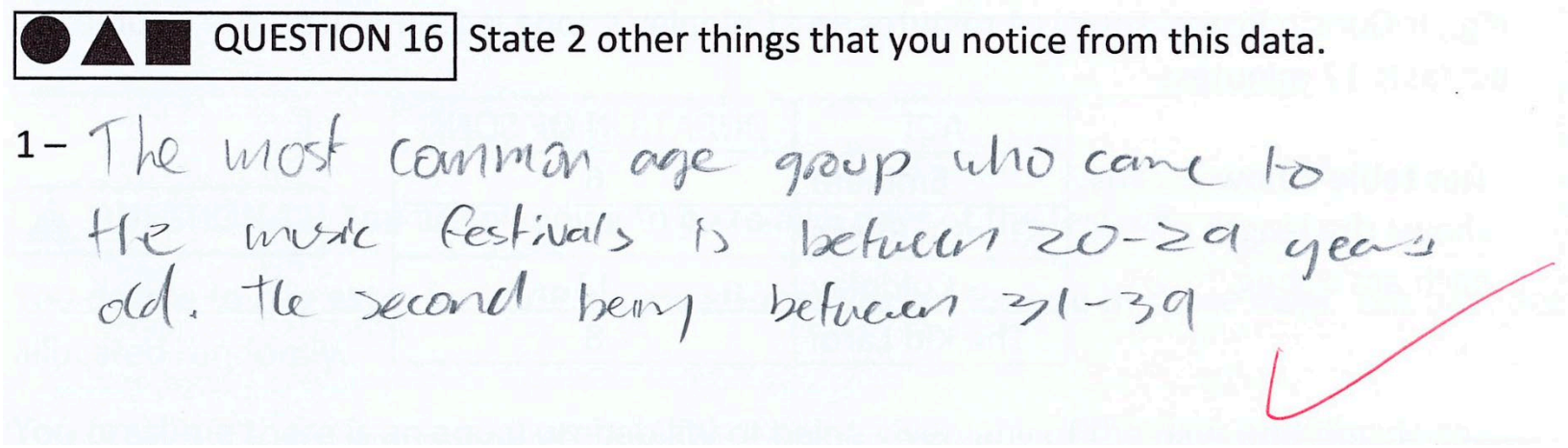


2nd Level of complexity



1st Level of complexity

SASC Student Responses


QUESTION 16 State 2 other things that you notice from this data.

1- The most common age group who came to the music festivals is between 20-29 years old. the second being between 31-39

2nd Level of complexity

Discussion: how to turn this into “3rd level of complexity”?

SASC Student Responses

2nd Level of complexity

Discussion: how to turn this into “3rd level of complexity”?

Design and application of assessment:

Modified CAT

FURTHER ADJUSTMENTS OF THE APPROACH TO CATER FOR DIVERSE LEARNING NEEDS

Guaranteed and viable curriculum

Four areas:

- Financial numeracy
- Statistics & Probability
- Measurement & Geometry
- Number & Algebra

IMPLEMENTATION AT KENSINGTON COMMUNITY HIGH SCHOOL: RUBRIC

1.10 Solves problems involving direct proportion		3.7 Use formulas to solve the perimeter of composite shapes.	4.10 Solve problems involving area of composite shapes	5.4 Understands the relationships between features of circles	6.9 Uses formula for the volumes of cylinders	7.10 Create a critieria to justify their thinking	Level 9: Students at this level can solve measurement problems involving perimeter and area of composite shapes, surface area and volume of rectangular prisms and cylinders, with and without the use of digital technology. Students can explain similarity of triangles, interpret ratios and scale factors in similar figures, to solve problems involving angles and lengths in right-angled triangles.
1.9 Solves a range of problems involving rates and ratios	2.9 Recognise the conversion factors for area and volume units	3.6 Use formulas to solve the perimeter of rectangles and triangles	4.9 Use formula for the area of triangles	5.3 Use formulas to solve problems involving circumference and area of circles	6.8 Uses formula for the volumes of triangular prisms	7.9 Justifies problem solving strategies	Level 8: Students at this level can convert between units of measurement for area and for volume. Students can name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. Students can identify conditions for the congruence of triangles and deduce the properties of quadrilaterals.
1.8 Multiplies and divides decimals by powers of 10	2.8 Choose appropriate units of measurement for area and volume	3.5 Measures the perimeter of composite shapes in millimetres, centimetres and metres	4.8 Use formula for the area of rectangles	5.2 Investigate the area of circles using a square grid	6.7 Uses formula for the volumes of rectangular prisms	7.8 Applies problem solving strategies	Level 7: Students at this level can use formulas for the area and perimeter of rectangles. They can classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students can calculate volumes of rectangular prisms.
1.0 Applying number skills	2.0 Using units of measure	3.0 Use familiar units to calculate the perimeter	4.0 Establish formulas and calculate the area of shapes	5.0 Solve problems with circles	6.0 Establish formulas and calculate volume & capacity of objects	7.0 Applying problem solving techniques	**Actions**

Implementation at Kensington Community High School: application

Flexibility & adaptability

- Teachers can adjust the questions to suit their students' needs.
- Teachers can challenge students further if students are excelling in certain areas.
- Each question is designed independently along the same learning continuum.

Three levels of complexity (Fluency, Problem Solving and Reasoning)

- Teachers use "Ready to Learn" scale to assess students' readiness.
- For students with low readiness, start with fluency tasks to ease into learning.
- Ensure everyone is engaged at a level that suits their current mindset and ability.

Curriculum based authentic task

- Students develop practical numeracy skill while connecting their learning to the real world.
- For students who have missed lessons or struggled with certain topics, this is a chance to revisit key skills.
- A valuable tool for teachers as part of formative and summative assessments.

Design and application of summative assessment: what worked well?

Enhanced the efficiency of teaching and assessment by covering multiple strands within the same unit.

Improved numeracy engagement by connecting learning activities and assessments to real life, and in particular, students' daily life.

Three levels of complexity (fluency, problem solving, and reasoning) are clearly outlined in the rubric.

Can be adjusted to make it suitable for Yr5-10 cohorts in different settings (primary, secondary and alternative).

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Be in it to WIN!