Introduction

This report documents the evidence I gathered in relation to some of the Australian Professional Standards for Teachers (APST) during my second practicum. The report serves as part the requirement for teachers to develop a professional portfolio of evidence supporting claims against each of the APST at Graduate level, and identify personal goals in relation to the standards (Australian Institute for Teaching and School Leadership , 2011)**.** This evidence will be presented throughout two sequences of three lessons (exclusive of the first observation lesson). with a Year 9 Stage 5.2 Mathematics class. Whilst a range of APST descriptors will be covered throughout the report, the reader's attention should also be devoted to the assessment-centric approach taken to inform my teaching (see Figure 1 below). The philosophy underpinning this approach is directly in line with that of Hattie's (2009) *Visible Learning*, which adopts the view that teachers are agents of change who must intervene in calculated and meaningful ways to guide their students to achieving learning goals.

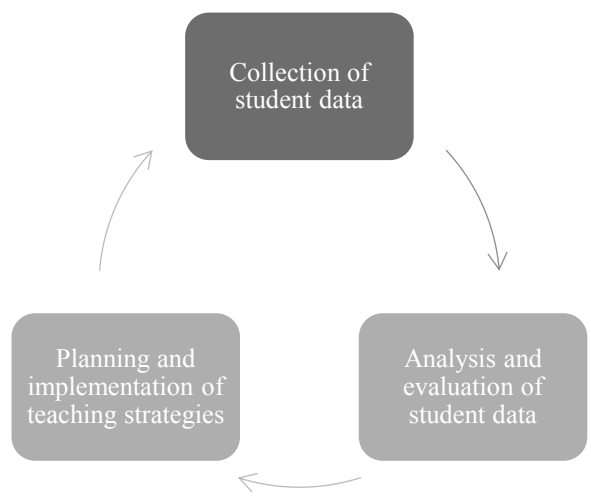
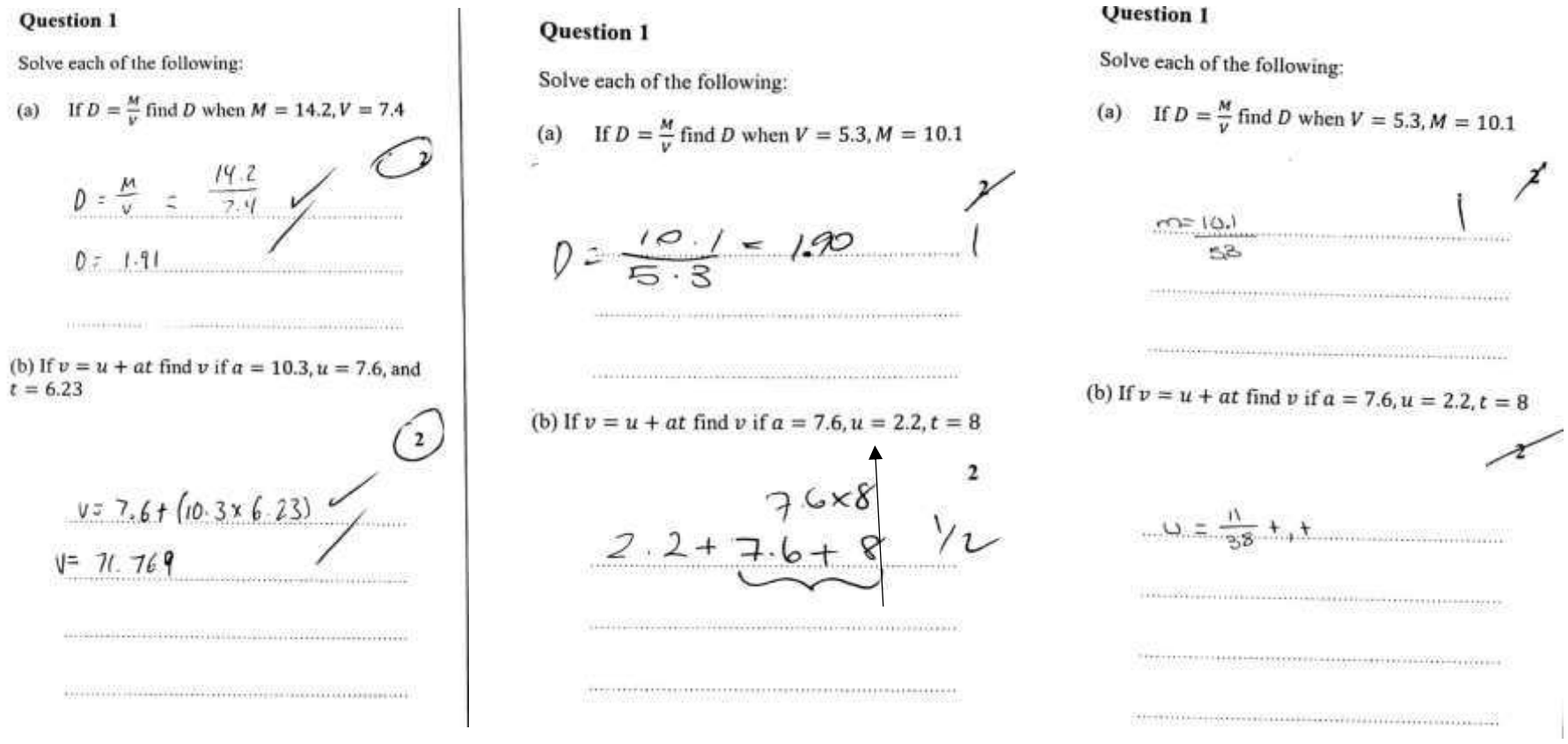


Figure 1 An assessment-centric approach to teaching

Lesson 1: Observation lesson



Question 1

Solve each of the following:

(a) If $D = \frac{M}{V}$ find D when $M = 14.2, V = 7.4$

$D = \frac{M}{V} = \frac{14.2}{7.4}$

$D = 1.91$

(b) If $v = u + at$ find v if $a = 10.3, u = 7.6$, and $t = 6.23$

$v = 7.6 + (10.3 \times 6.23)$

$v = 71.769$

Question 1

Solve each of the following:

(a) If $D = \frac{M}{V}$ find D when $V = 5.3, M = 10.1$

$D = \frac{10.1}{5.3} = 1.90$

(b) If $v = u + at$ find v if $a = 7.6, u = 2.2, t = 8$

7.6×8

$2.2 + 7.6 + 8$

Question 1

Solve each of the following:

(a) If $D = \frac{M}{V}$ find D when $V = 5.3, M = 10.1$

$m = \frac{10.1}{53}$

(b) If $v = u + at$ find v if $a = 7.6, u = 2.2, t = 8$

$u = \frac{11}{38} + , +$

Figure 2 A, C and E student samples from post-test.

5.4 Use student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice

Prior to my first teaching lesson, I produced a diagnostic test to be administered at the end of my Supervising Teacher's lesson to gather evidence on students' learning to date. Diagnostic testing serves the purpose of finding out what the learner knows, determining where they are going and planning for how they will get there (Hattie & Timperley, 2007).

3.6 Evaluate personal teaching and learning programs using evidence, including feedback from students and student assessment data, to inform planning

A, C and E samples were taken from students, with the majority of students falling into the C and E categories. Many students did not know what they were being asked to find the value of the pronumeral. Furthermore, many students incorrectly carried out the substitutions. Observations during the class also revealed that numeracy and literacy may be an issue. The Unit of Work below illustrates my planning in response to these observations.

The data gathered from my classroom observations, discussions with my supervising teacher and the student samples in figure 2 above informed my development of a new Unit of Work for the topic to replace the existing Unit of Work supplied by the school. The Unit also contains the content and how I intend to teach it and draws a direct link between each lesson and the target syllabus outcomes.

Unit of Work: Formulae and Problem Solving	
Aim For students to develop problem-solving skills and see mathematics as a language by using algebra and equations to model and solve worded problems.	**Unit Length** 6 × 45-minute less
Syllabus Outcomes • Selects appropriate notations and conventions to communicate mathematical ideas and solutions MA5.2-1WM • Interprets mathematical or real-life situations, systematically applying appropriate strategies to solve problems MA5.2-2WM • Constructs arguments to prove and justify results MA5.2WM • Solves linear and simple quadratic equations, linear inequalities and linear simultaneous equations, using analytical and graphical techniques MA5.2-8NA	**Mathematical Pro** • Fluency an the subject • Problem sc introducing critically al • Understanc
Literacy • Metalanguage – 'linear equation', 'quadratic equation', 'pronumeral/variable', 'substitution', 'y-axis and x-axis' 'make the subject of', 'sketch the graph of …', 'expression', 'formula' • Explicit instruction: 'Let … then … so … therefore …' • Discuss misconceptions such as the difference between $4 \div 2$ vs. $2 \div 4$	**Numeracy** • Analysing • Relational understanding of equations
ICT & Resources • Geogebra to model relationship between area and width of a rectangle; Mathletics • Compound assessments • Powerpoints and worksheets	**Strategies** • Explicit instruction: 'I do, we do, you do' • Quality student samples • Faded and compounded examples • Authentic tasks and Polya questioning

2.5.1 Develops lesson plans, observation notes and discussion about lesson content and structure that show knowledge of a range of teaching strategies to support literacy and numeracy development

Literacy and numeracy development is supported via the use of explicit instruction to teach the metalanguage and metacognition throughout the topic (Hattie, 2009). In addition, the use of acronyms are incorporated to support students' numeracy by assisting their development of problem-solving schema (Woolfolk & Margetts, 2015).

The strategies for literacy and numeracy are intended to address the difficulties evident from the student samples in figure 2 above. A combination of clear meaning from literacy strategies and clear structure from numeracy strategies will equip students with the skills required for problem solving.

Figure 3 Unit of Work

Lessons	Syllabus Content and Considerations	Teaching, Learning and Assessment
1	Use algebraic symbols to represent mathematical operations written in words and vice versa • The order of operations can be confused, e.g. '3 less than 5 means 5 – 3'. Similarly, divide 6 by 2 is different to 2 divided by 6 • Use of brackets for the purposes of PEMDAS, e.g. 'divide the sum of 3 and 2 by 5' Translate from everyday language to algebraic language and vice versa • Use algebraic symbols to represent situations described in words, e.g. write an expression for the number of cents in x dollars • Interpret statements involving algebraic symbols in other contexts	The aims of this lesson are to: • Establish ground rules for setting out, homework and behavior via explicit instruction and quality samples • Motivate the topic – the language of mathematics and generalising arithmetic • Use a concept map and glossary sheet to review the terms used to represent $+, -, \times$ and $\div$ ○ In the glossary, include examples to emphasise PEMDAS and literacy implications for ordering • Use worked examples with the 'I do, we do, you do' model
2	Create algebraic expressions and evaluate them by substituting a given value for each pronumeral ssions and ula are values of x^2 for same magnitude nphasising use of	The aims of this lesson are to: • Assess for learning of content in prev • Model how to correctly demonstrate writing and executing the substitutio to evaluate the subject of a formula you do' • Provide samples for students to understand why they must use brackets for substitution of negative quantities and square terms

2.2.2 Organise content into coherent, well-sequenced learning and teaching programs

Content outcomes from the syllabus are divided and allocated into a "lesson itinerary" to give direction for teachers and students. The sequencing of each lesson orders the syllabus content outcomes in a logical fashion. For example, students are taught to become familiar with algebraic symbols before using them to evaluate for missing pronumerals.

3.2.2 Plan and implement well-structured learning and teaching programs or lesson sequences that engage students and promote learning

This Unit includes a range of teaching considerations and strategies that were selected to engage and promote student learning. The strategies are selected so that they are appropriately aligned with the content. For instance, concept mapping through a class discussion is used to review the concepts of basic operations; glossaries and acronyms are used to support students' literacy by encouraging elaborative rather than maintenance rehearsal to increase the likelihood of long-term memory storage (Sweller, 1994).

3	Substitute values into formulas to determine an unknown • Solve equations arising from substitution into formulas, e.g. $P = 2l + 2b$ and $P = 20$, $l = 6$, find b • Solve problems and interpret solutions, e.g. $A = \frac{1}{2}xy$, $v = u + at$, $C = \frac{5}{9}(F -$	The aims of this lesson are to: • Assess for learning of content in previous lesson • Model how to make a pronumeral the subject of an equation 'I do, we do, you do' • Use an authentic substitution problem and provide students with a real-world context for problem-solving. • Use student samples to demonstrate

4 and 5	Solve problems involving linear equations, including those derived from formulas
	• Translate word problems into equations, solve the equations and interpret the solutions
	  ○ State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years'
	  ○ Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle
		The aims of these lessons are to:
		
		• Assess for learning of content in previous lessons
		
		• Use compounding/faded examples to model the DESE (data, equation, substitution, evaluation) model using 'I do, we do, you do'
		
		  ○ Make instruction explicit with regards to defining pronumerals and writing full sentences in responses.

Figure 3 Unit of Work

Lessons 2 and 3 (Double period)

Lesson Details			
Teacher Education Student	[redacted]	**School**	
Lesson Duration	100 minutes	**Year/Class**	9 Mathematics 5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Equations arising from Substitution		
Syllabus Outcomes	Substitute values into formulas to determine an unknown • Solve equations arising from substitution into formulas, e.g. $P = 2l + 2b$ and $P = 20$, $l = 6$, find b • Solve problems and interpret solutions, e.g. $A = \frac{1}{2}xy$, $v = u + at$, $C = \frac{5}{9}(F -$ 32)		
Lesson Intentions	Students can perform substitutions accurately Students can find specific pronumerals in a given formula.		
Assumed knowledge	Some familiarity with substitution Familiar with terms such as pronumeral, substitution and equation Some basic algebra conventions such as $ab = a \times b$ and $\frac{a}{b} = a \div b$		
Differentiation	Exercises will be graded by difficulty		
Focus for literacy	Terminology: pronumeral, substitute, the subject		
Focus for numeracy	Formulas arising in the real world such as area of triangle, simple interest and perimeter will be discussed		
Focus for ICT	N/A		
Resources and WHS	Powerpoint Signpost 5.1-5.2		

2.1.1 Clearly articulates and explains the central concepts of the subject, linking the content, outcomes and activities to key syllabus documents

The lesson intention is directly drawn from the syllabus outcomes and articulated in a manner that is understandable to both teachers and students. Specific examples prescribed by the syllabus are also identified and addressed within the lesson plan.

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction (10 minutes)	T clarifies learning intention with S' using a flow chart T encourages S' to ask Qs about the purpose/direction of the topic	May ask questions or make comments to clarify the learning intentions	S comments/questions can be used to adjust how learning goals are presented

Body (80 minutes)	T provides explicit instruction for substitution involving equations: 1) Substitute 2) Simplify 3) Isolate using opposite operations T uses **faded and compounding** examples: $v = u + at$ Find u, a and t $V = \frac{Ah}{3}$ Find A, h $K = \frac{1}{2}mv^2$ Find m, v $A = \frac{1}{2}h(x + y)$ Find h, x, y T directs student to the exercises (11:04 Q1 – 4 – stick to Qs with whole numbers only) and ANY one question from 6, 7 or 8. T directs S' to Mathletics assessment.	S' write down examples S' ask questions and can make comments S' attempt some problems on their own	Frequency counts and time sampling to measure student engagement T should actively monitor for students' understanding by asking questions and checking their work T uses 'no hands up' questioning to ensure that evidence of learning is drawn from a more reliable cross-section of students Corrective feedback can be obtained by drawing on the ideas of other students in the class
Conclusion (10 minutes)	T concludes the lesson by reviewing key concepts learned	S' begin on exercises S' may ask questions for clarification	S' responses during the review can be used as a rough gauge for understanding of content.

Figure 4 Lessons 2 and 3 (Plan)

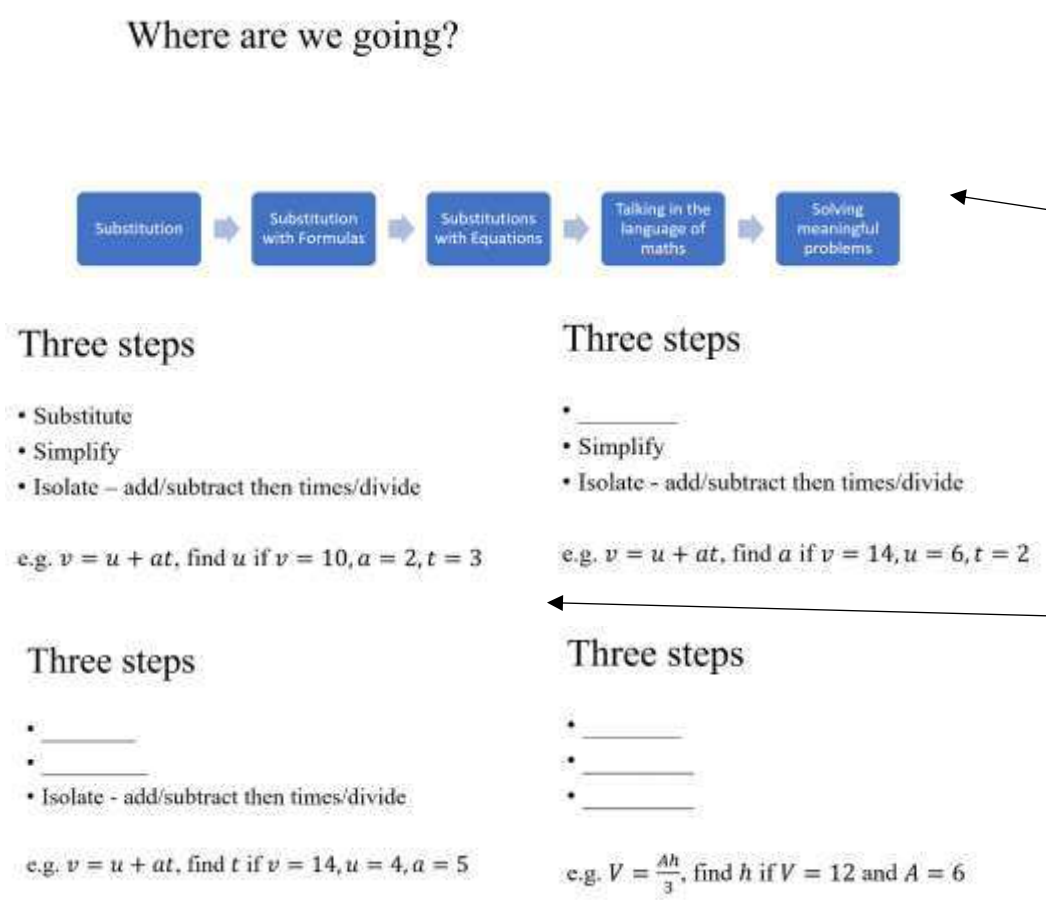


Figure 5 Explicit Instruction and Faded guidance

<u>3.1.1 Communicates clear and appropriate learning goals, taking into account syllabus and student diverse learning needs and continually evaluates student progress against these goals</u>

The goals and sequencing I constructed in the Unit of Work was communicated to students in a succinct and coherent manner via a flow chart to ensure that every student had a clear understanding of the long-term learning intention (William & Leahy, 2015). The short-term goals were communicated verbally to students against the backdrop of these long-term goals.

<u>3.3.1 Uses an extended range of teaching strategies and adapts them while teaching in response to changing needs of the students</u>

Explicit instruction was combined with faded examples in response to the data from lesson 1, which indicated that the students were still novice learners who were still developing the relevant schema (Kissane, Kalyuga, Chandler, & Sweller, 2008).

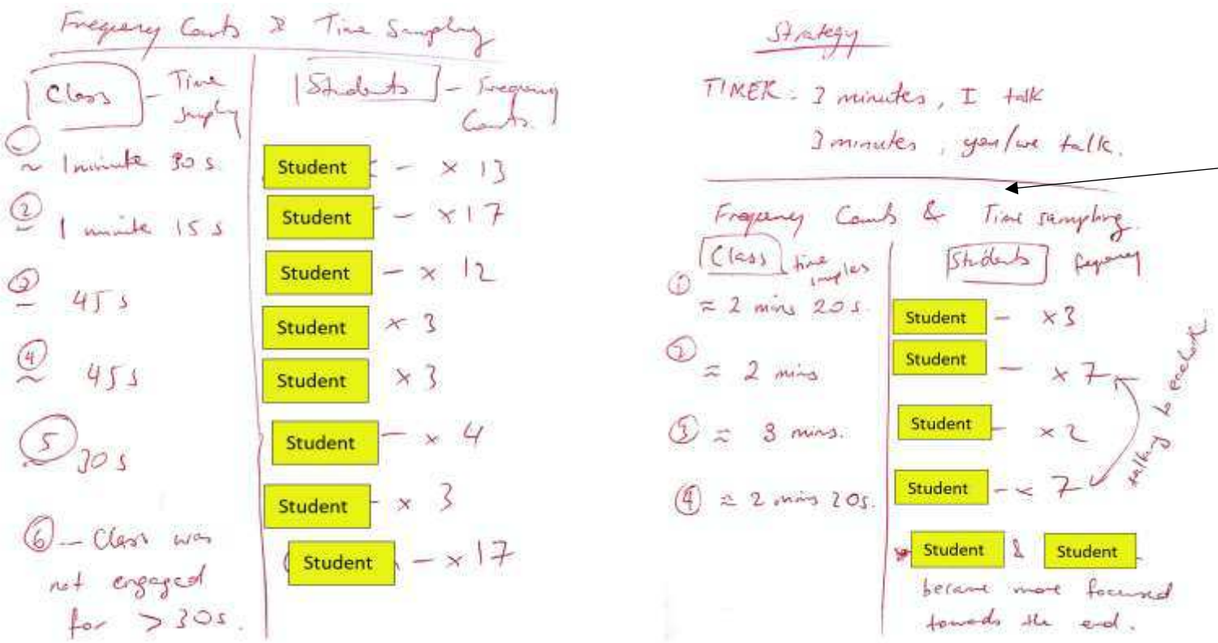


Figure 6 Frequency Counts and Time Samples

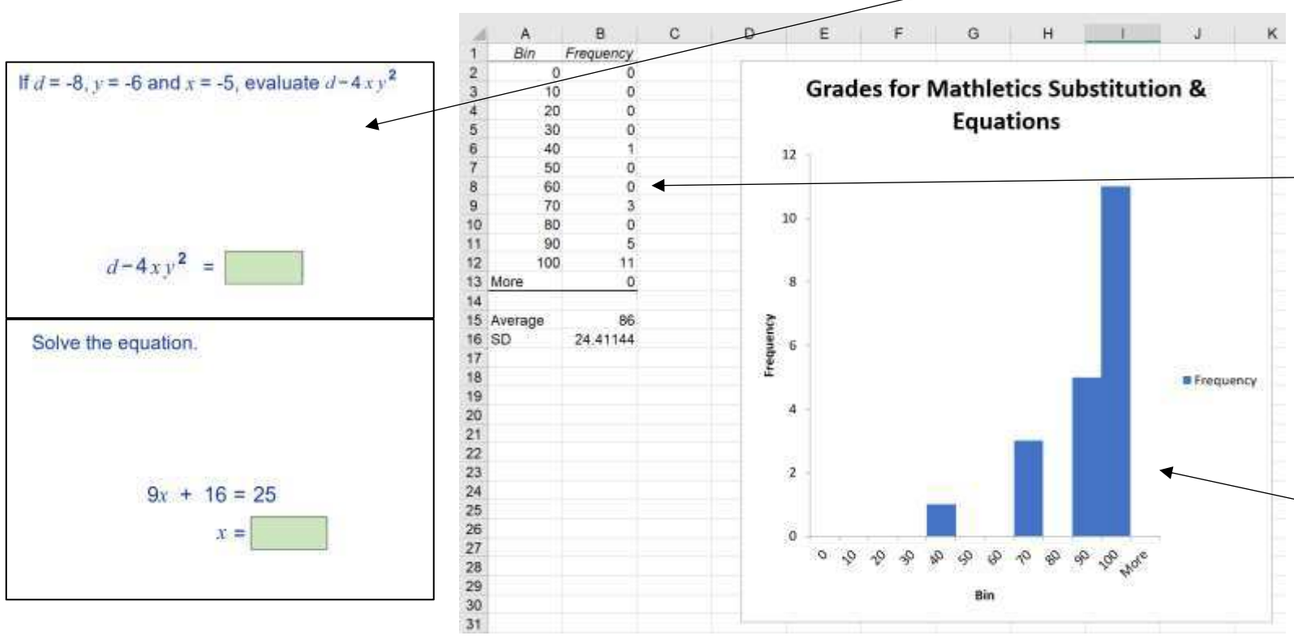


Figure 7 Data Analysis from Mathletics

4.2.2 Establish and maintain orderly and workable routines to create an environment where student time is spent on learning tasks

+

4.3.1 Responds to challenging behaviour quickly, fairly and respectfully, applying judgment based on the context in accordance with school policies, and applies student management techniques that are fair, appropriate and consistent

In the first half of lesson 2, increasing amounts of off-task behaviour from students within the class resulted in shorter periods of engagement. In response to these circumstances, I decided to conduct a frequency count and time sampling to quantify students' off-task behaviour (Lingo, Barton-Arwood, & Jolivette, 2011). The initial findings are recorded on the left of Figure 6 below. I observed that students' behaviour stemmed from a desire to talk to their peers, as many students within the class were close friends outside of the classroom. Thus, I decided to negotiate and establish a routine with students to address this (3-minutes I talk, 3 minutes you/we talk). The right hand side of Figure 6 demonstrates an immediate and effective response from the students.

5.1.1 Designs and delivers a wide variety of formative and summative assessment activities to formally monitor student learning, including the analysis of student work samples for diagnostic purposes to inform differentiation and future assessment strategies and tasks

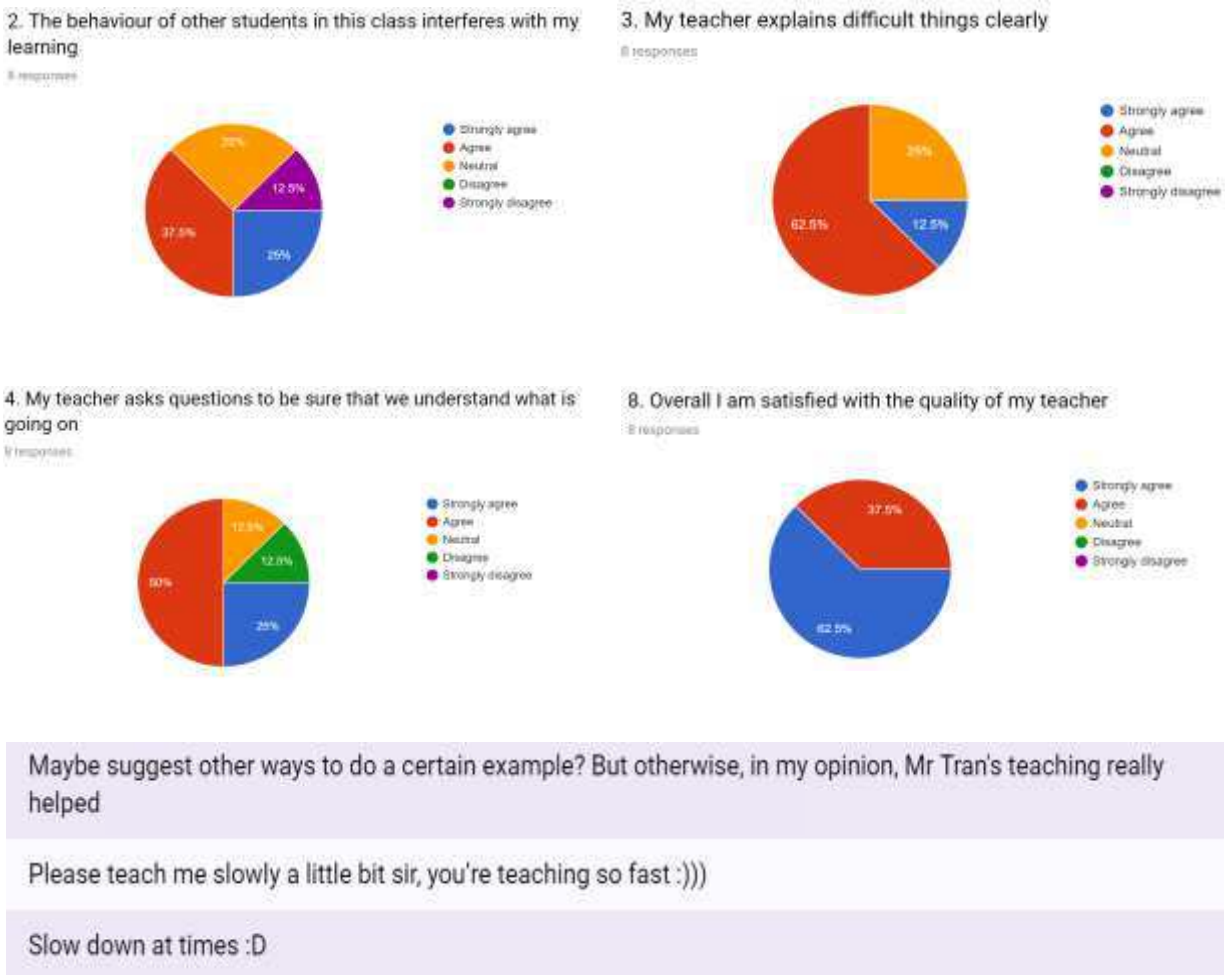
For this lesson, I chose to use the weekly Mathletics period to assess students' learning via an online task, since students were already previously assessed via writing. The problems were selected in accordance with the content that was taught.

5.5.1 Employs a variety of methods to record evidence gathered through assessment activities and an effective approach to collecting, organising and storing assessment data consistent with school policies and procedures

I took advantage of the import data function built into the Mathletics software to collect information from students' responses. The data was provided to me in the form of an Excel spreadsheet listing student names, their responses and scores. Student privacy is easily kept by anonymising student names and the records of student data were consistent with the school's procedures for record-keeping of informal assessment. The mean, standard deviation and histogram for students' performance were produced using Excel.

5.4.2 Use student assessment data to analyse and evaluate student understanding of subject/content, identifying interventions and modifying teaching practice

The data indicated that students responded well to the teaching strategies implemented in my lesson. This is evident in the high average (86%) with a mild standard deviation. Furthermore, the plot of student data is highly negatively skewed, suggesting that an overwhelming majority of students had achieved the desired outcomes. There was, however, one student who did not score over 50%, due to a technological issue.



In addition to value-added data, I sought feedback from both my Supervising Teacher and the students. Both the Supervising Teacher's comments and students' responses indicated that off-task behaviours in the class were an issue that still needed to be addressed. However, my Supervising Teacher did recommend that I continue implementing the timer rule as it was effective with the class.

Moreover, he students' responses indicated that whilst the explanations were clear, the pace needed to be reduced. Interestingly, one student comment requested that I showed students alternative ways of doing an example. This gave me the idea of incorporating differentiation strategies in my teaching, which could satisfy both of these requests from students.

Lesson 4

Lesson Details			
Teacher Education Student		**School**	
Lesson Duration	50 minutes	**Year/Class**	9MA5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Translating problems into equations		
Syllabus Outcomes	Translate from everyday language to algebraic language and vice versa • Use algebraic symbols to represent situations described in words, e.g. write an expression for the number of cents in x dollars ○ Interpret statements involving algebraic symbols in other contexts Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions		

	○ State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years' Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle
Lesson Intentions	For students to be able to recognise the following: Sum, add → + Subtract, take away, take from, minus → − Divide, share, split → ÷ Lots of, multiply, product → × Students use Algebra to express relationships
Assumed knowledge	Sum, add → + Subtract, take away, take from, minus → − Divide, share, split → ÷ Lots of, multiply, product → × Basic literacy
Differentiation	Open questioning and brainstorming to accept a wide range of responses; graded problems
Focus for literacy	Terminology '3 -2' can be written as '3 take away 2' or 'Take 2 from 3' - Oracy
Focus for numeracy	Students develop their numeracy as they solve problems by framing a problem mathematically.
Focus for ICT	N/A
Resources and WHS	Prescribed text – 11:01 Powerpoint

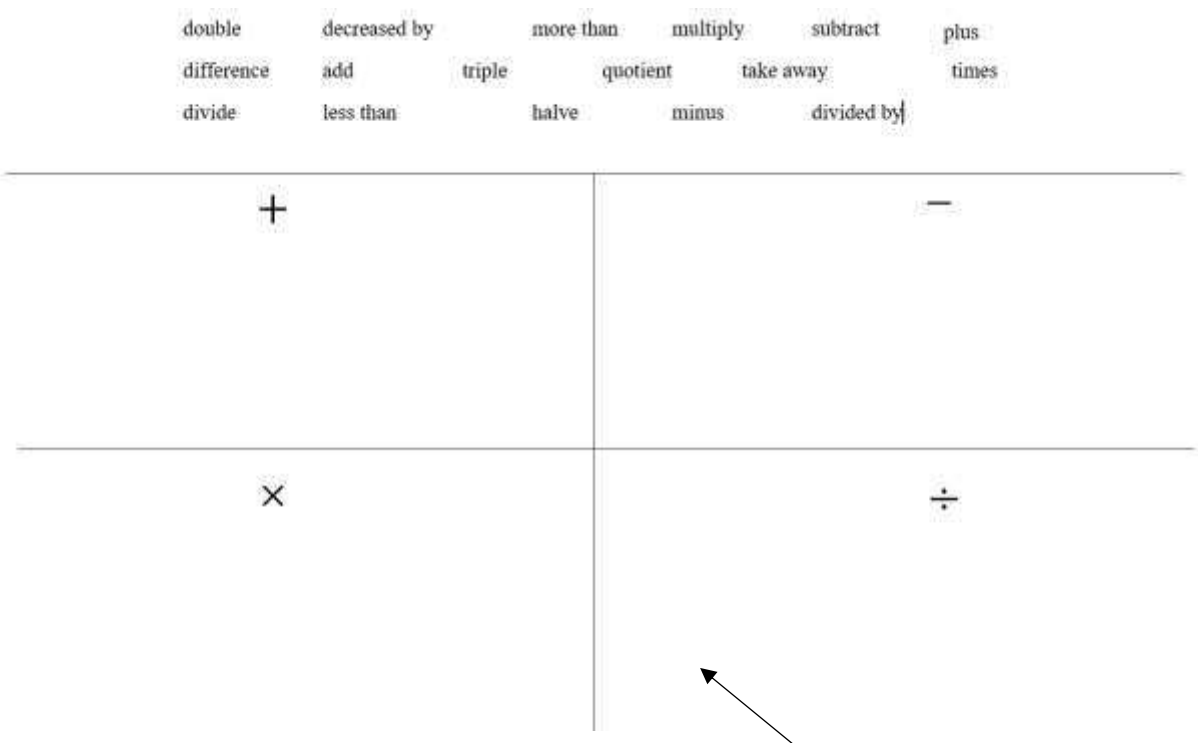
The next lesson was planned with data from the prior lesson in mind. Thus, there is emphasis on differentiation, continued use of worked examples and scaffolding and the 3-minute routine as a classroom management strategy.

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction (15 minutes)	**3-minute timer routine used throughout** T brainstorms mathematical words for $+, -, \times, \div$ T applies these to concrete examples and then increases abstraction. E.g. The sum of 3 and 4 is… The sum of x and y is … T starts a class discussion with open-questioning (True of False and why?) • $4 - 3$ is not $3 - 4$ • $4 \div 2$ is not $2 \div 4$	S' contribute to the class discussion and add to the brainstorm S' explain their solutions to the class verbally.	T assesses S' literacy through verbal and written responses T gives verbal and written corrective feedback S' responses will inform need for T to give explicit instruction for literacy S' give teacher a thumbs up or thumbs down to indicate understanding
Body (25 minutes)	T sets the following problems: 11:01 Qs 3 – 8, 10, 12, 16, 17 Challenge – Qs 15 and 18 T marks the roll	S' begin on problems S' ask questions for clarification	T actively monitors to manage behaviour and provide assistance and feedback by checking S' work T gauges S' understanding based on their progression through the exercise
Conclusion (10 minutes)	T gives a post-test (quick quiz)	S' set reminders for their quizzes and	N/A

3.5.2 Use effective verbal and non-verbal communication strategies to support student understanding, participation and engagement

Students are provided feedback from myself and their peers through verbal descriptions of mathematical sentences. Non-verbal strategies such as thumbs up/thumbs down is used to gauge for class-wide understanding and serves as feedback for me to adapt my teaching practice. Corrective feedback was used for small or subtle errors such as incorrect grammar. In these instances, delivery of corrective feedback was subtle (e.g. rephrasing).

Figure 8 Lesson 4 (Plan)



True or False?

"Take three from four"

is the same as

"Take four from three"

True or False?

"Divide four by two"

is the same as

"Two divided by four"

The product of:

a) 7 and 6 is:

b) 5 and q is:

c) p and q is:

4.1.2 Establish and implement inclusive and positive interactions to engage and support all students in classroom activities

The class brainstorm and discussion was a strategy used to get students to take on a more adversarial role. Every students' contribution, whether correct or incorrect, is highly valuable to this exercise, as conjectures and misconceptions are all addressed via discussion. Whilst students may not know the answers to the questions, they can nevertheless decide to support or refute the arguments of their peers.

1.5.2 Designs and implements teaching strategies that are responsive to the learning strengths and needs of students from diverse linguistic, cultural, religious and socio-economic backgrounds

The majority of students within the class were still operating at lower levels of thinking. I planned to address this by beginning with concrete examples and building in abstraction in order to help students transition their thinking from the concrete operational to formal operations (Woolfolk & Margetts, 2015).

Students who are already operating at higher levels were challenged with the True/False exercise. Differentiation is achieved through open questioning (Roth, 1996) when students are asked to explain why the claim is true or false. Students may respond in a range of ways – either through visual depictions or grammatical explanations to justify the order of an operation.

Figure 9 Use of concrete examples building up to abstraction and classroom activities (brainstorms and open-questioning) for differentiation

6.3.1 Responds to constructive feedback in a positive and professional manner, and acts upon it promptly to set realistic short and long term goals in negotiation with their supervising teacher

Feedback from both my Supervising Teacher and students was taken into account in differentiating my teaching and managing classroom activities to promote engagement.

In my post-lesson reflection, I wrote a short statement based on comments from the students and my Supervising Teacher based on how I responded to feedback. The outcomes of the lesson indicated to me that I had responded in a timely and constructive manner.

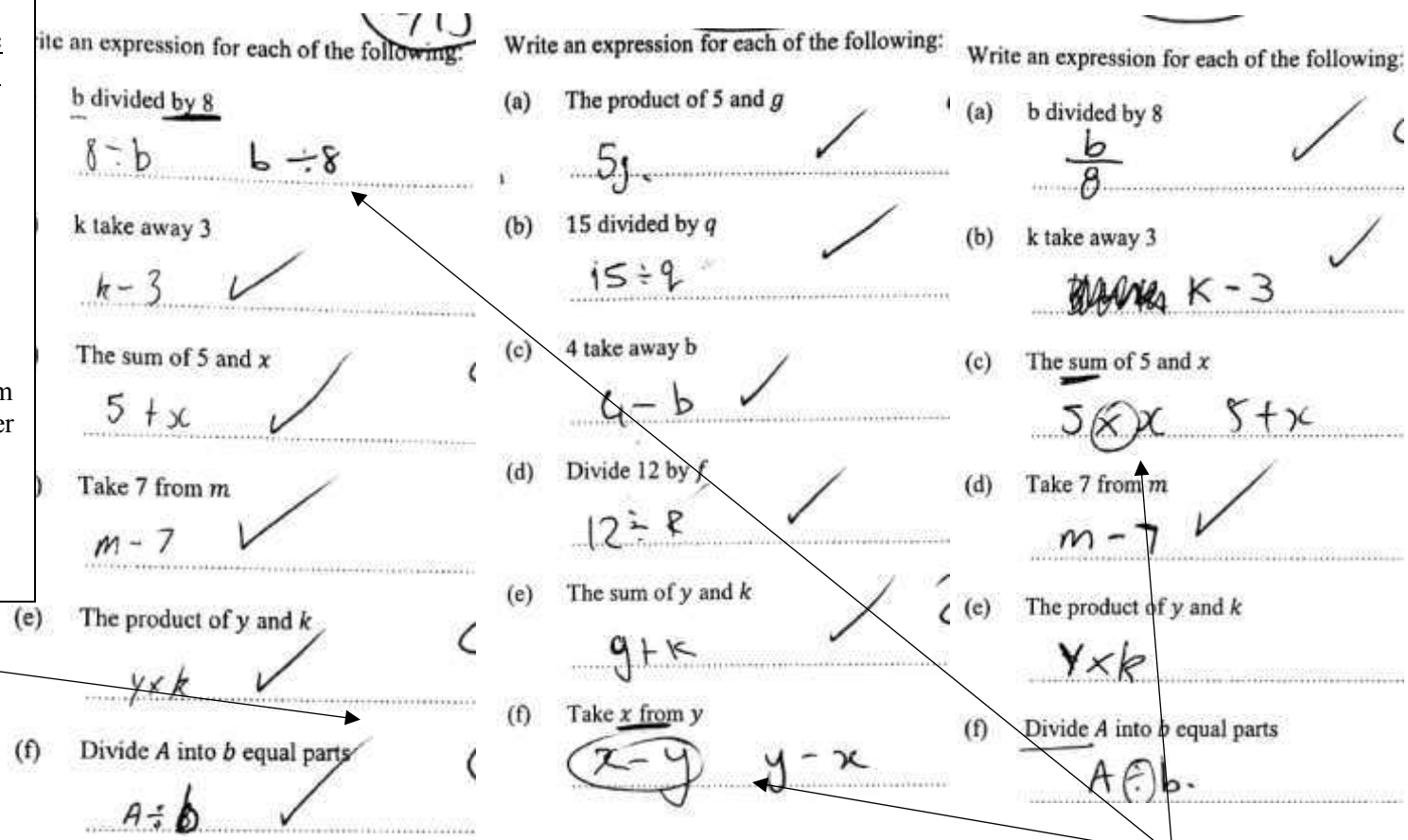
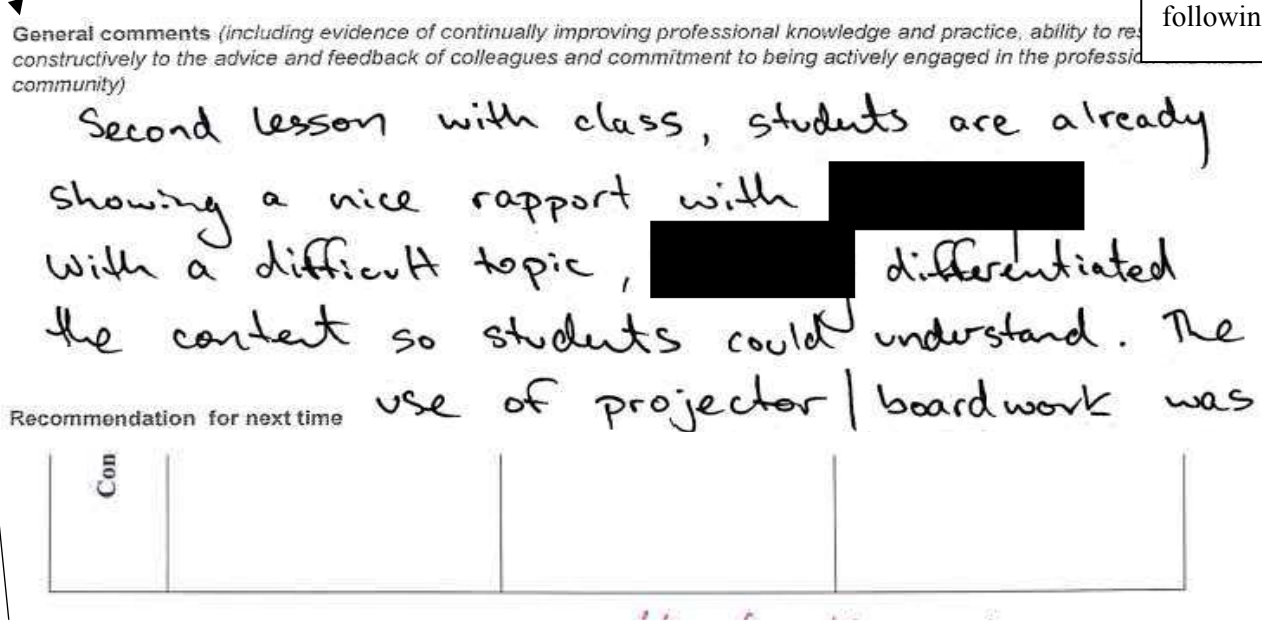


Figure 10 A, C and E samples from post-test

Students successfully distinguish between the order in which operations occur, but still make minor errors. This needed to be made more explicit in the following lesson.



Again, samples were taken from the same students from the initial A, C and E samples taken in lesson 1. The student achieving C-level outcomes exhibited an improvement to A-level outcomes, whilst the E-level student exhibited an improvement to C-level outcomes. Thus, I decided that students possessed sufficient knowledge and skills to progress to the final section of the topic. The strategies used above were maintained in the next lesson.

Lesson 5

Lesson Details			
Teacher Education Student	[redacted]	**School**	[redacted]
Lesson Duration	50 minutes	**Year/Class**	9 Mathematics 5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Translating problems into equations		
Syllabus Outcomes	Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions ○ State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years' Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle		
Lesson Intentions	Students learn to convert worded problems into equations (one and two-step) Students review how to solve equations Students learn to interpret their solutions		
Assumed knowledge	All content covered in the unit thus far – substitution, generalised arithmetic, making a pronumeral the subject		
Differentiation	Problems will be graded by difficulty Various amounts of scaffolding		
Focus for literacy	Defining pronumerals (e.g. Let n be the number of …) Writing sentences to explain working (Let … then … therefore …)		
Focus for numeracy	Students will learn to transfer these problem-solving skills to real-world contexts by converting everyday problems into equations		
Focus for ICT	N/A		
Resources and WHS	Powerpoint Prescribed text		

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction [15 minutes]	T displays a roadmap of S' learning: substitution → formulas → generalised arithmetic → **solving meaningful problems** T briefly reviews simple substitutions T briefly reviews terms for $+, -, \times, \div$	S' participate to the review S' take down notes from the review PPT	T uses questioning to elicit evidence of learning T provides corrective feedback by drawing on the input of other S' in the class
Body + Conclusion [35 minutes]	T gives S' the following problem-solving steps: 1) Operations 2) Equation – let the mystery number by x 3) Solution Examples – T uses e.g's supplied in the text, prompts above are faded along the way T marks roll T sets exercise problems – 11:05 Q's 1 – 7 (E.S.P) T administers quick quiz	S' take down notes from the PPT S' contribute to the class discussion S' ask questions and make comments for clarification S' begin on exercise problems Students complete quiz	T uses questioning to elicit evidence of learning T provides corrective feedback by drawing on the input of other S' in the class T should use 'no hands up' and call out names to assess for understanding

Review is used as an opportunity to address misconceptions from last lesson.

Figure 11 Lesson 5 (Plan)

Steps

1) Identify the operations $(+, -, \times, \div)$

2) Write an equation
   - **Let the unknown be x**
   - Write an equation using the sentence provided

3) Solve the equation

Example

A number subtracted from 28 is 12. Find the number.

1) _____
2) _____
3) Solve it

Example

A number multiplied by 3 is 111. Find the number.

1) Identify operations

2) Write an equation

3) Solve it

Explicit instruction and faded guidance are still used to for scaffolding. Students are lead into independently solving problems.

I think of a number, double it, add 3 and the result is 33. What is the number?

$(x \times 2) + 3 = 33$
$x = 15$
$(15 \times 2) + 3 = 33$
$30 + 3 = 33.$
$x = 15$

I think of a number, double it, add 3 and the result is 33. What is the number?

$x \times 2 + 3 = 33$
$-3 \quad -3$
$\frac{x \times 2}{2} = \frac{30}{2}$
$x = 15$

I think of a number, double it, add 3 and the result is 33. What is the number?

$x \times 2 + 3 = 3$
$-3 \quad -3$
$x \times 2 = 0$
$\div 2 \quad \div 2$
$x = 0$

The A, C and E samples were taken once more. The students in the first two samples demonstrate a clear understanding of the problem solving process and equation-solving. The third student has also demonstrated this, but has made an error at the beginning that has carried.

Comments from my Supervising Teacher indicated that I should continue to use these strategies and to ensure that I continually assess students on content from previous lessons where possible.

Fading examples and guiding students into working independently has also had a positive effect on their sense of autonomy – many students felt prepared to tackle more difficult problems on their own after the clues and steps were hidden away. This response is well-aligned with the findings of Deci and Ryan (2000) that autonomy support is a major factor in boosting intrinsic motivation.

Excellent introduction, overall picture
~~* Isolate add/sub the times/divide ?~~
* Good questioning skills
* Good that you corrected students on how an operation is said.
  $10 \div 5$, $5 \div 10$
* Good that you gave students an opportunity to do an example by themselves.

Figure 12 Evidence of Impact

Lessons 6 and 7 (Double Period)

Lesson Details			
Teacher Education Student	[redacted]	**School**	
Lesson Duration	100 minutes	**Year/Class**	9 Mathematics 5.2
Curriculum Area	Mathematics	**Topic**	Formulas and Problem Solving
Lesson Title/Focus	Problem Solving and Review		
Syllabus Outcomes	Solve problems involving linear equations, including those derived from formulas • Translate word problems into equations, solve the equations and interpret the solutions ○ State clearly the meaning of introduced pronumerals when using equations to solve problems, e.g. 'n = number of years' Solve word problems involving familiar formulas, e.g. 'if the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle		
Lesson Intentions	Students learn to use all of the skills obtained in this unit to solve worded problems by: - Translating worded problems into equations - Solving equations - Interpreting their solutions		
Assumed knowledge	All content from this unit from prior lessons		
Differentiation	Problems will be graded by difficulty		
Focus for literacy	Students interpret and translate worded problems		
Focus for numeracy	Students transfer their problem solving skills into practical real-world scenarios		
Focus for ICT	N/A		
Resources and WHS	Powerpoint Prescribed text – 11:06		

Teaching and Learning Sequence			
Timing	**Teacher does and says**	**Students do and say**	**Assessment & feedback**
Introduction [40 mins]	T runs a feedback activity: "spot the error" and invites S' to discuss in groups where mistakes have been made in a sample of student work T distributes a marking rubric to show students how outcomes will be assessed. T asks S' to participate in matching rubric outcomes to the sample before them.	S' discuss in pairs or small groups to identify the error in the sample and explain how/why	Feedback is achieved through peer learning as S' explain their solutions to one another T also receives feedback on misconceptions to address as S' explain their solutions

Figure 13 Lessons 6 and 7 (Plan)

Body [40 minutes]	T explicitly instructs S' on how to solve a problem: Data – what do I know? What do I want to find? E quation S olve E valuate e.g. 1 – rectangle with length three times width – **ICT (Geogebra) is used to model this problem** e.g. 2 – age question – a woman is twice as old as her daughter. If the sum of their ages ten years ago was 30, how old are they now? e.g. 3 – price of goods question – 3kg apples and 5 kg oranges at a total of $22 If oranges are $2 a kilo, how much are apples? T sets problems – 11:06, Q1, 2, 3a, c [Optional challenge] – Q4a, b	S' contribute to class discussion S' ask questions and make comments for clarification S' take notes from PPT slides S' work on set problems independently	T uses questioning to elicit evidence of learning T provides corrective feedback by drawing on the input of other S' in the class T should use 'no hands up' and call out names to assess for understanding
Conclusion [20 mins]	T administers a short post-test T hosts a final Q&A about the topics assessed or about general exam advice	S' all contribute	T receives feedback from S' on the quiz

Figure 14 Lessons 6 and 7 (Plan)

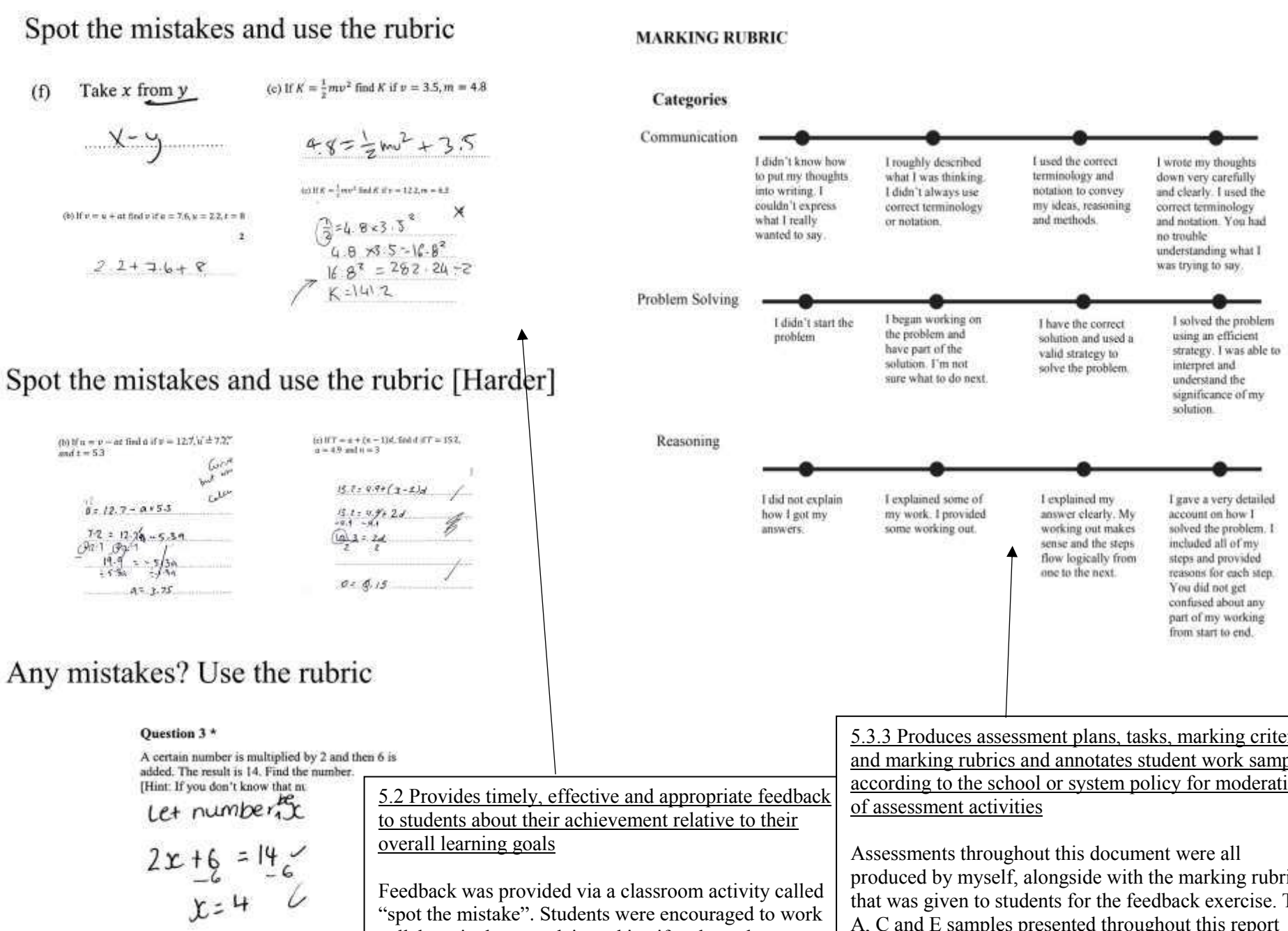


Figure 14 Strategies Incorporated

5.2 Provides timely, effective and appropriate feedback to students about their achievement relative to their overall learning goals

Feedback was provided via a classroom activity called "spot the mistake". Students were encouraged to work collaboratively to explain and justify why or how answers may be incorrect and what a correct solution required. The task was designed to clarify the intention and outcomes of the topic in accordance with the principles of assessment and feedback proposed by William and Leahy (2015).

5.3.3 Produces assessment plans, tasks, marking criteria and marking rubrics and annotates student work samples according to the school or system policy for moderation of assessment activities

Assessments throughout this document were all produced by myself, alongside with the marking rubric that was given to students for the feedback exercise. The A, C and E samples presented throughout this report served as typical responses for the purposes of moderation, to be used by other staff members who chose to administer my quizzes in their own classes.

Topic Name -

Definition and Explanation Briefly What is the topic or process about (1-2 sentences)

Criteria for Evaluation What are some of the value judgement type words that can be used to demonstrate that the impact or effect of the aspects or an application of the topics or process is positive and or negative, beneficial or harmful, advantageous disadvantageous valid invalid?

Name and Identify What are the main components/elements of the topic/ or the steps /stages of the process	Define/Describe Each feature or component. What is it? What are the properties?	Explain How and Why? Cause and Effect of each feature/ component/ stage	Analyse How are the implications/ impact of this process or the features/ components related? Explain how or why intent carried out, what relationships between components are there.	Critically Analyse How each feature is beneficial or not even if implied as related to a set criteria. Explain how or why they are + or-.	Evaluate, Justify, Assess Make a judgment on each component based on the implications, has each feature served its purpose? Are they successful? + vs – which outweighs which.
				+ -	
				+ -	
				+ -	

Evaluate Overall/Critically Evaluate - After all individual components have been evaluated or justified compare and contrast all areas. To what extent is one more effective than another? Come to a final judgment. Were all features/processes successful or effective?

Conceptualise Topic. Essential idea of topic or process or change in process/idea summed up or judged, over time. Includes Interrelationships amongst the areas or features

Appreciate Topic Concept. Why is this topic process important for life, where is it relevant, Why should it be learned, why is it important to evaluate the overall situation?

How to Solve Problems

D – Data/Diagram
E - Equation
S – Substitution/Solving
E – Evaluation

Finish this off:

A woman is 9 years older than her sister. If the sum of their ages is 39, how old is each person?

Let the age of the sister be x. Then the age of the woman is x+9.

Since the sum of their ages is 39:

Finish this off:

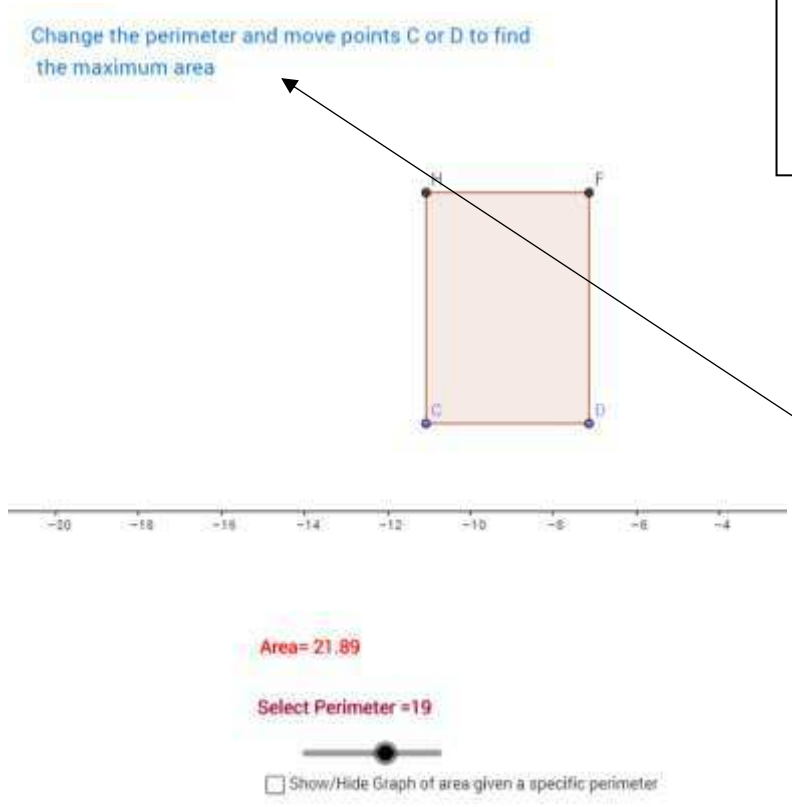
In a class of students there are 5 more girls than there are boys. If there are 29 students altogether, how many boys and girls are there?

Let the number of boys be n. Then the number of girls is…

6.4.2 Undertakes professional learning programs to address identified student learning needs

Literacy and numeracy strategies mentioned in the Unit of Work are implemented to scaffold and support students' problem-solving skills.

The DESE acronym was aligned with a professional learning session that I attended as part of the school-wide ALARM (A Learning and Responding Matrix), which scaffolds students' progression through to the higher levels of thinking of Bloom's Taxonomy. For example, students who are operating at lower levels (identifying, describing) are supported in their progression to higher order thinking skills (evaluation, analysis). The DESE approach essentially contextualises ALARM in a mathematical setting.



2.6.2 Uses effective teaching strategies to integrate ICT into learning and teaching programs to make selected content relevant and meaningful

The use of the mathematical software Geogebra plays a crucial role as students reach the milestone of solving authentic problems in this topic. In particular, the role of technology here is not to simply serve the purpose of computations, but to act as students' learning partners by assisting them in developing new ideas and testing old ones (Goos, 2010). Geogebra is used to model the relationship between the area and width of a rectangle, and the activity will involve students forming conjectures, testing hypotheses and formulating arguments and observations using the skills they develop from this topic.

Figure 15 Strategies Incorporated

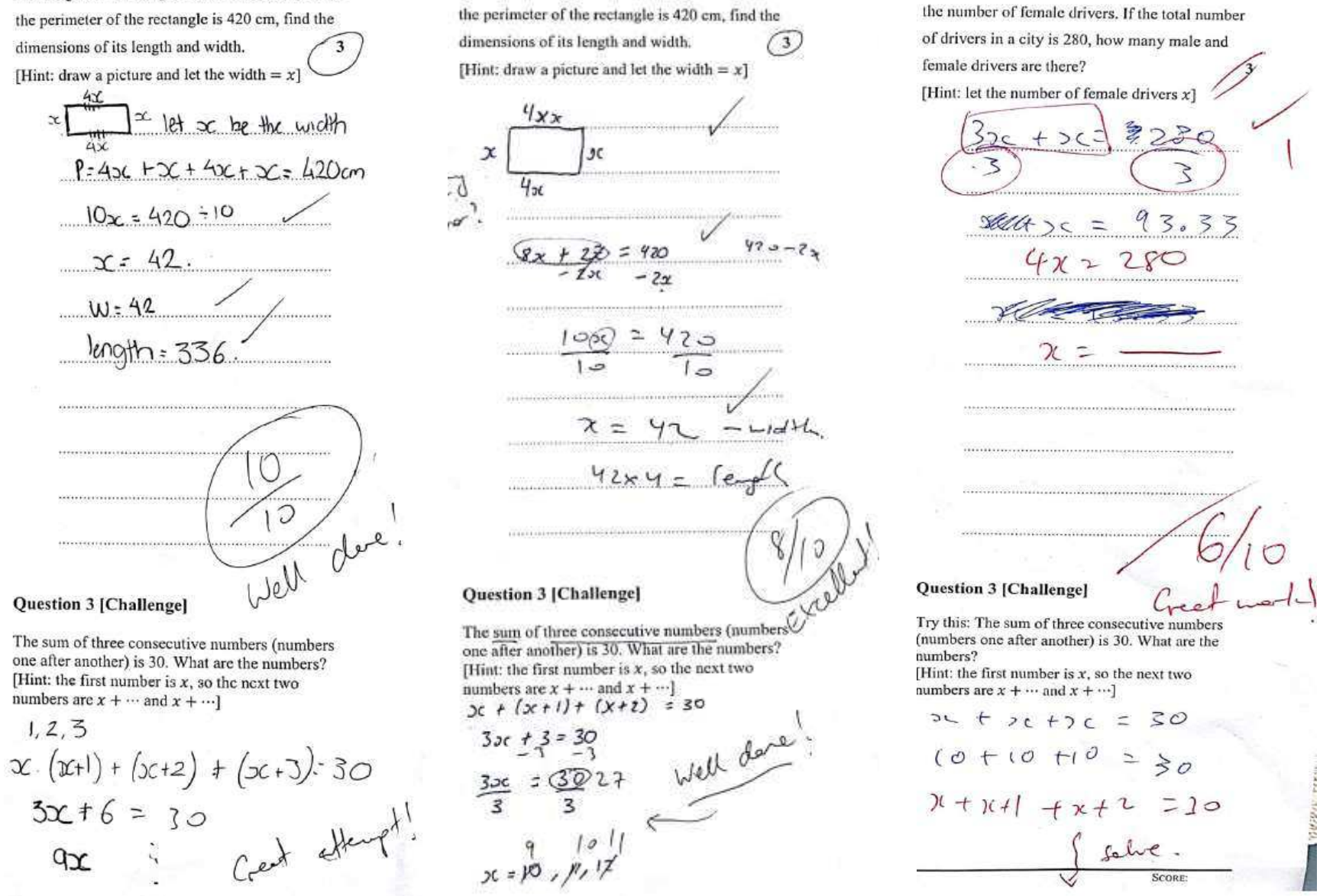


Figure 16 Evidence of Impact

The final set of A, C and E samples taken (Figure 16) demonstrate that students responded quite well to the general DESE approach. Students who stuck to the approach demonstrated a greater likelihood of success. The student in the last sample was correct in their approach and only made errors in working out. This was the last lesson before students sat the yearly exams. I was able to obtain results from their exams and sought to analyse the medium-term progress made by the students. These findings are presented below.

Semester 2 Assessment	Semester 2 Portfolio	Yearly Exam	Semester 2 Total	Total Assessment Mark	Yearly Course Rank	Yearly Grade
x / 100	x / 100	x / 100	x / 100	x / 100	x / 83	
7.27		21.00	N/A	N/A		N/A
38.00		20.00	N/A	N/A		N/A
39.00		45.00	N/A	N/A		N/A
48.00		58.00	N/A	N/A		N/A
30.00		45.00	N/A	N/A		N/A
38.00		52.0	N/A	N/A		N/A
26.00			N/A	N/A		N/A
50.00		27.00	N/A	N/A		N/A
30.00		38.00	N/A	N/A		N/A
33.00		45.00	N/A	N/A		N/A
14.00			N/A	N/A		N/A
16.00		24.0	N/A	N/A		N/A
30.00		38.00	N/A	N/A		N/A
28.00		25.00	N/A	N/A		N/A
24.00		51.00	N/A	N/A		N/A
20.00		22.00	N/A	N/A		N/A
58.00		60.00	N/A	N/A		N/A
20.00		42.00	N/A	N/A		N/A
26.00		27.00	N/A	N/A		N/A
4.00		20.00	N/A	N/A		N/A
22.00		44.00	N/A	N/A		N/A
68.00		69.00	N/A	N/A		N/A
50.00		49.00	N/A	N/A		N/A
18.00		27.00	N/A	N/A		N/A
44.00		23.00	N/A	N/A		N/A
28.00		33.00	N/A	N/A		N/A
22.00		24.00	N/A	N/A		N/A

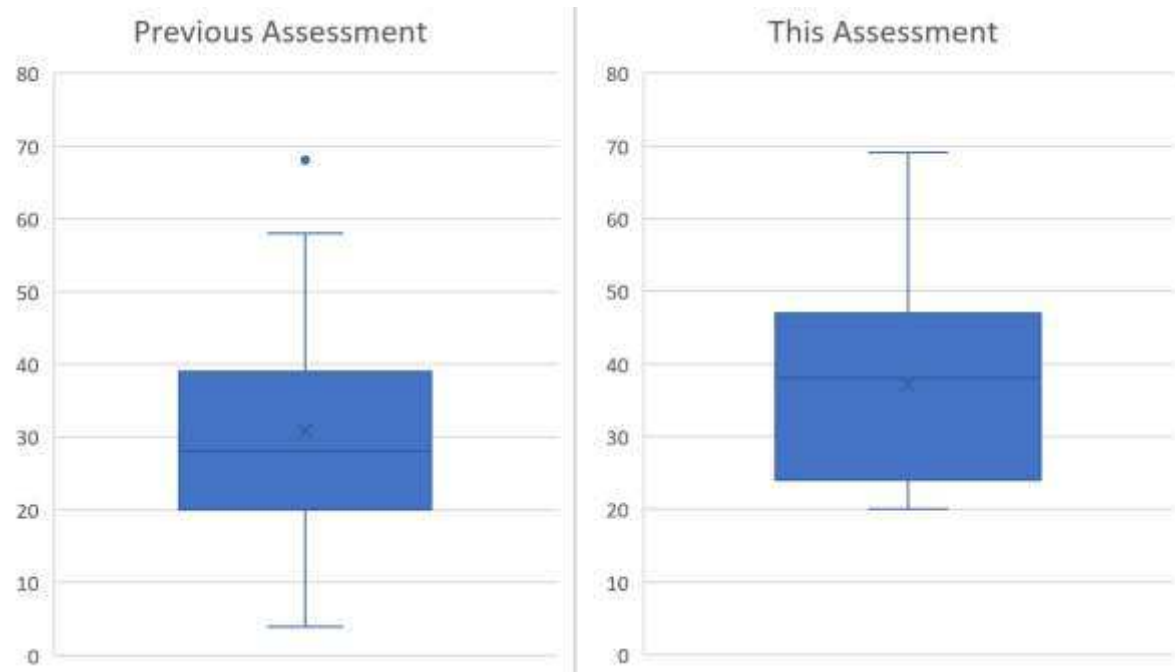


Figure 17 Evidence of Medium Term Impact

The box-and-whisker plot reveals that the median, lower and upper quartile of scores in this assessment are all higher than in the previous assessment, indicating that the majority of students improved since their last assessment. On the other hand, the results for this assessment were negatively skewed, whilst results in the previous assessment were approximately normally distributed. This suggests that there are some students in the class that will benefit from being challenged further, whilst the main group of students will continue to benefit from the strategies incorporated during my lessons.

Importantly, these results would need to be explained to students, as many students would interpret a result below 50% to constitute "failure". Emphasis would need to be placed upon students' improvement consistent with the principles of a "Growth Mindset" (Dweck & Legget, 1988).

Conclusion

This report has mapped both my journey in developing my teaching practice and the students' learning journey by exhibiting evidence of how I adapted my teaching in response to the data that was obtained from the students. Figure 18 below provides a snapshot of where I currently am in my teaching journey. It was produced during a reflective discussion between my Supervising teachers and myself and mediated by a University Liaison.

[Final word count for annotations only: 2806]

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