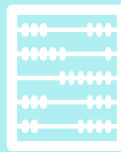


DR ANGE ROGERS



Place Value: Assessment and Targeted Instruction

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Notes

Record any notes as we move through the session



Notes



Ideas



Reflection

The 6 Aspects of Place Value

Use the 6 aspects to guide your teaching of whole number and decimal place value

The 6 aspects form a structure to base place value teaching around. They provide a shared definition of place value and encourage everyone to use the same language across the school.



The 6 aspects of Place Value

1

NAME/RECORD

- Read and write a number in words and figures
- Identify the names of each place value column
- Identify the value of digits in a number

2

COUNT

- Counting forwards and backwards in place value parts
- Bridging forwards and backwards over place value segments
- Identify the number before, after, next in a sequence
- Understand the idea of more, less, greater, larger, between

3

MAKE/REPRESENT

- Make, represent or identify the value of a number using a range of materials or manipulatives.
- proportional (e.g., base-ten blocks), non-proportional (e.g. coloured counters)
- canonical (e.g., 3 tens and 9 ones is 39) or non-canonical (e.g., 2 tens and 19 ones is 39)

4

RENAME

- Rename numbers in multiple ways in terms of place value parts without the use of manipulatives
- 47 is equivalent to 3 tens 17 ones, 2 tens 27 ones etc

5

COMPARE/ORDER

- Compare numbers to determine which is larger or smaller
- Compare numbers in a multiplicative manner. e.g. tens times larger
- Locate numbers on empty, partially marked or complete number lines.
- Rounding numbers to the nearest place value part.

6

CALCULATE

- Apply knowledge and understanding of the place value system when completing calculations using the four operations

THINKING MISTAKE

When students attempt to record numbers, they often completely ignore place value conventions and simply write the numbers they recognize (in this case four hundred and seventy-three). Or as you can see below, they concatenate numbers, writing each part in sequence, for example (four hundred thousand, then 73).

Write in numbers:
Four hundred thousand and seventy three.

473

400,00073

TEACHING TIP

When we teach reading and writing numbers, we should encourage students to chunk (within the periods) and observe patterns (between the periods). Just as in literacy it is ok for students to be able to read some words they don't understand, it is perfectly ok for students to read and write numbers they have no comprehension of... yet! This place value houses template is very useful to teach the structure of our number system. Once students see the structure and conventions of recording numbers, they rarely make the errors seen above.

Billions			Millions			Thousands					
H	T	O	H	T	O	H	T	O	H	T	O

Reference: www.nzmaths.co.nz

Place value houses template

Reference: www.nzmaths.co.nz

Billions			Millions			Thousands					
H	T	O	H	T	O	H	T	O	H	T	O

Count

THINKING MISTAKE

We all know there are 'flash points' that cause difficulties for students when they count. Going forwards or backwards over a place value part, whether it be tens, hundreds, or thousands is a challenge. The sample below illustrates this difficulty

Continue the following pattern . . .

178, 168, 158, 148, 138, 128, 118, 108, 100, 92

TEACHING TIP

Pattern is critical in counting. Whenever you count, provide students the chance to observe the pattern they are creating. In the above example, you could ask questions like: what do you notice is happening in the tens column? ones column? I also like to link renaming with counting. For example, 13 tens 8 ones, 12 tens 8 ones, 11 tens 8 ones, 10 tens 8 ones,. What comes next? Don't assume students notice patterns- often they are just rote counting-make them think!

138, 128, 118, 108, 98, 88

138 is 13 tens, 8 ones

128 is 12 tens, 8 ones

118 is 11 tens, 8 ones

108 is 10 tens, 8 ones

98 is 9 tens, 8 ones

88 is 8 tens, 8 ones

Count and Roll is played with 2 players. The game gives students practice with skip counting by 1/10/100.

Materials

- Blank piece of paper/whiteboard for each player
- 1 pen/whiteboard marker to share
- 1 Six sided dice

How to Play

Before the game:

Decide a number to start on and a number to skip count by (ones, tens or hundreds), for example start at 102 and count by 10s.

Begin the game:

Player One begins skip counting by 10s at 102 and recording this down their own page/whiteboard. Meanwhile, Player 2 is rolling the dice. Player 2 keeps rolling until 'one' is rolled. When this happens, Player 2 yells "swap" and Player 1 passes the marker to Player 2. Player 2 then begins recording their skip counting **on their own page/whiteboard**.

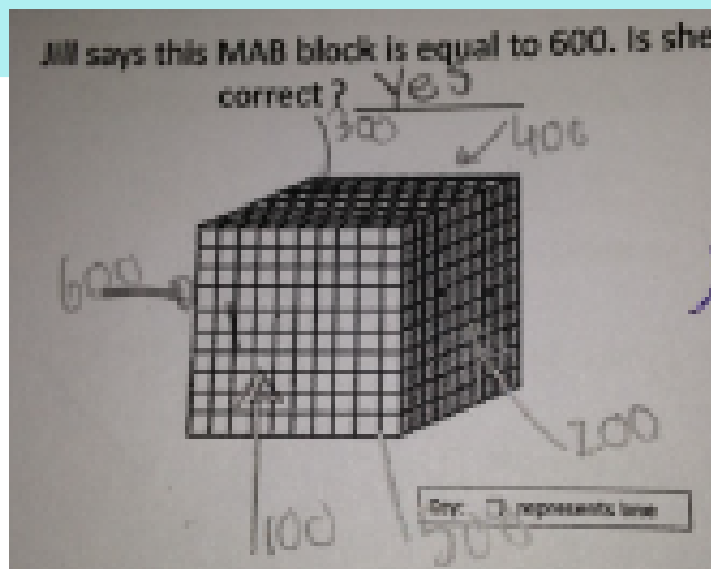
While this is happening Player 1 is trying to roll a 'one'. Once Player 1 rolls a 'one', they yell 'swap', and it is their turn to continue **their count on their own whiteboard**.

The first person to reach a nominated number for example 412 is the winner.

N.B. Game can be played counting by 1s, 10s or 100s forwards or backwards

THINKING MISTAKE

In my research I found around 24% of Year 3-6 students believe (or are not convinced otherwise) that the MAB (Base 10) thousand block has a value of 600 below. This thinking mistake stems from students counting each face of the thousand block as 1 hundred, so 6 by 1 hundred is 600.



TEACHING TIP

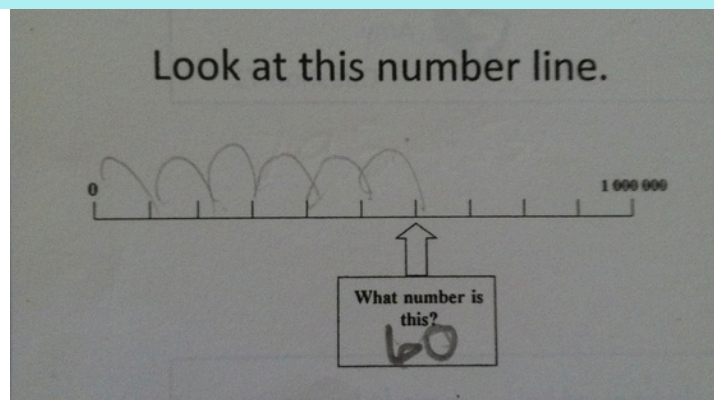
Avoid plastic MAB (Base 10) thousand blocks- these are not weighted like the wooden sets, and feel hollow, reinforcing the 600-block issue. Let students discover the value of the MAB thousands block themselves. Hand them the block and simply say, 'I want you to discover and prove to me the value of this block'. Sticking together hundred blocks with blu-tac is a highly valuable part of this activity.



Compare/Order

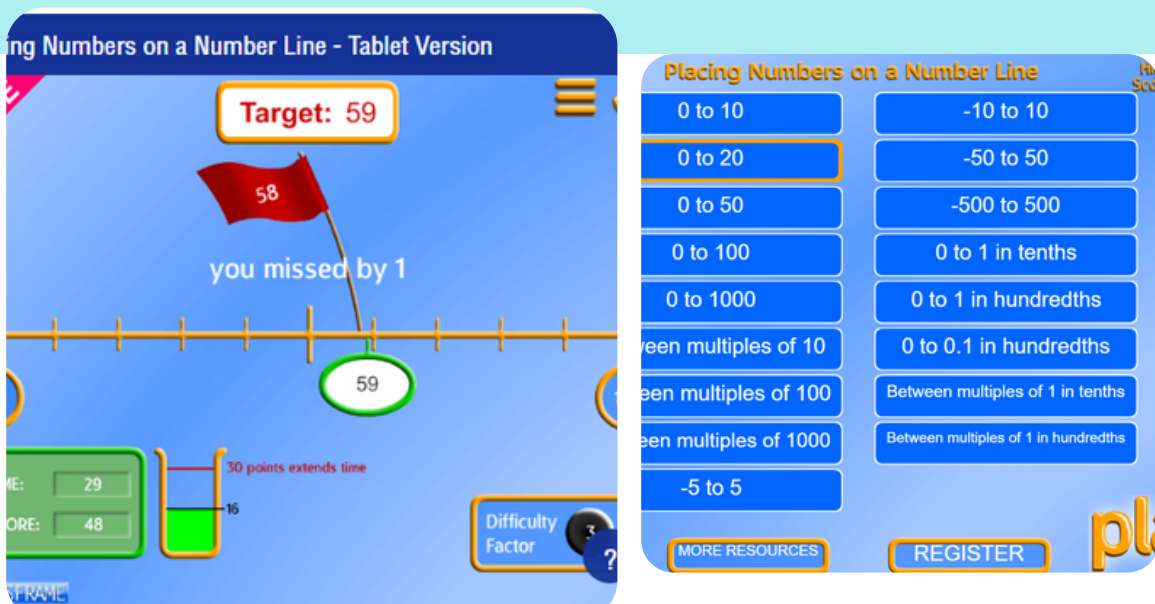
THINKING MISTAKE

One critical part of this aspect is using number lines. Siemon et al. (2011) describe the skill of sequencing or positioning on a number line, for example, 'Identify where 62, 34 and 17 are on a 0-80 number line', as requiring a deep appreciation of place value and the relative magnitude of the numbers. In my research I found many students do not take notice of the numeral at the start and the end of the number line, and/or they find it difficult to identify the value of the increments.



TEACHING TIP

'Placing Numbers on a Number Line' is a fantastic free resource to work on sequencing numbers. You can find the website [here](#). It has a variety of number ranges to choose from and allows students to develop and refine their proportional reasoning skills.



3 in a Row Number Line

3 in a Row Number Line is played in pairs. The purpose is to help students practice ordering numbers

Materials

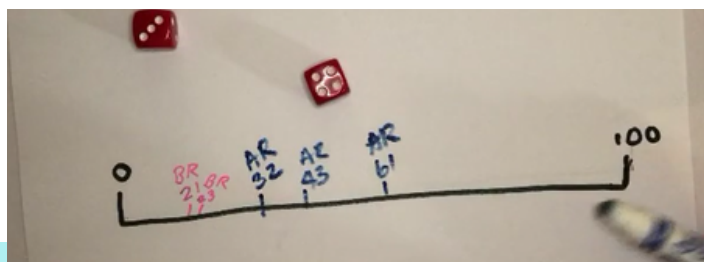
- Whiteboard for each player
- Different colored whiteboard marker for each player
- 2 x 0-9 dice

How to Play

Students draw a number line from 0 to 100 on their whiteboard. They then take turns to throw the 2 dice and make a 2-digit number (e.g., if I roll 3 and 4 I can chose to make 34 or 43). They write their number on 0-100 number line estimating where each number should be placed on the line.

The winner is the player that gets three numbers in a row without another player getting a number in between (e.g. 34, 40, 45 without another player having a number in between these numbers).

This game can be modified by changing the range of numbers on the empty number line and amount of dice used. For example, you could play on a 0-10 line and if I roll 3 and 4, I can choose to use 3.4, 4.3 0.43 or 0.34



Rename

THINKING MISTAKE

My research found that up to 80% of Year 3 students, 48% of Year 4 students, and 15% of students in Years 5 and 6 display the characteristics of Independent Column Thinkers (Rogers, 2014). These students believe each place value column does not relate to the others. This stems from an over-emphasis on the idea that “this is the hundreds column and hundreds live in there”. From this, students fail to understand the multiplicative idea that hundreds are composite units with smaller ‘tens’ and ‘ones’ units ‘hiding’ within them. The figure below shows the typical response of an Independent Column Thinker- they simply ignore the fact that 1 hundred can be renamed as 10 tens.

1 hundred, 6 tens, 7 ones is the same as . . .

6 tens 7 ones

TEACHING TIP

We know renaming is an abstract concept for students, but visualisation can assist students to develop their understanding. To introduce this idea, I use Russian nesting dolls. These dolls help to reinforce the idea that in place value there are smaller units within larger units. I encourage the students to close their eyes. If we are talking about the number 356, I ask them to imagine 3 of the ‘hundreds dolls’. I then ask how many smaller ‘tens dolls’ would be inside each, and ask them to visualise them being ‘let out’. There would be 10 tens in each hundred, so 30 tens. This visualisation assists students to appreciate there are units within units and that each column is related to the others.



Place Value Battles

(From James Russo and Toby Russo, 2019)

Place Value Battles can be played with 2-5 players. The purpose is to help students become proficient at renaming numbers.

Materials

Materials: Base-10 blocks, 3x 10-sided dice, mini white-boards and markers.

How to Play

Player A rolls three 10-sided dice and constructs a three-digit number, using one of the dice to represent each of the hundreds column, the tens column and the ones column (e.g., 235).

Player A and Player B (and any other players) rename the number. For example, Player A might choose 2 hundreds, 3 tens and 5 ones. Player B might choose 2 hundreds, 35 ones. Player C might choose 1 hundreds, 13 tens and 5 ones. Player D might choose 0 hundreds, 22 tens and 15 ones. Each player records their renamed number. Beginning with the hundreds column, players reveal their renamed number. The player who has the highest number recorded in each place value column (hundreds, tens and ones) receives one point. In the event of a tie, neither player is awarded a point. For example, in this example, the hundreds battle was a tie (2 vs 2), Player D 'won' the tens battle (22 vs 13) and Player B 'won' the ones battle (35). So Player D and Player B receive one point each

The game continues until one of the players records 11 points (or 21 points)



Calculate

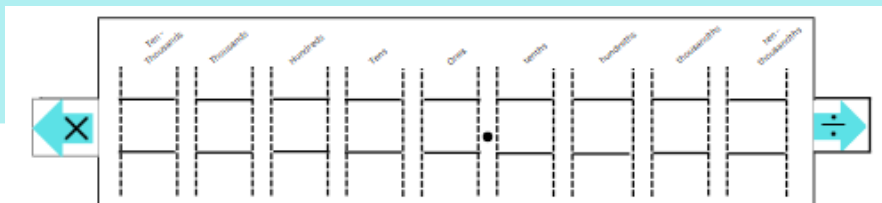
THINKING MISTAKE

Students need scaffolding to see that if we are multiplying or dividing by a place value unit (10,100,1000) we can simply move the digits (the decimal point does NOT move). For example, in the equation below, we want students to recognise it is highly inefficient to use the traditional algorithm.

A photograph of a greenboard showing a handwritten multiplication problem. At the top right, it says "10 x 23 406 =". Below this, the student has written "23406" followed by "x 10" on the next line. A horizontal line is drawn under "23406". Below the line, the student has written "00000" and "234060" on two separate lines. A second horizontal line is drawn under "234060". At the bottom of the board, the student has written "234060" as the final result.

TEACHING TIP

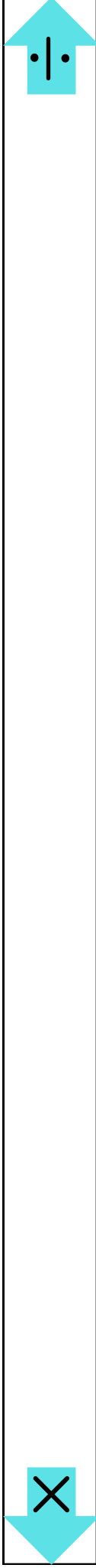
A Number Slide (see following page) is a perfect resource to help students visualise the idea that the digits are moving when you multiply or divide by powers of ten.



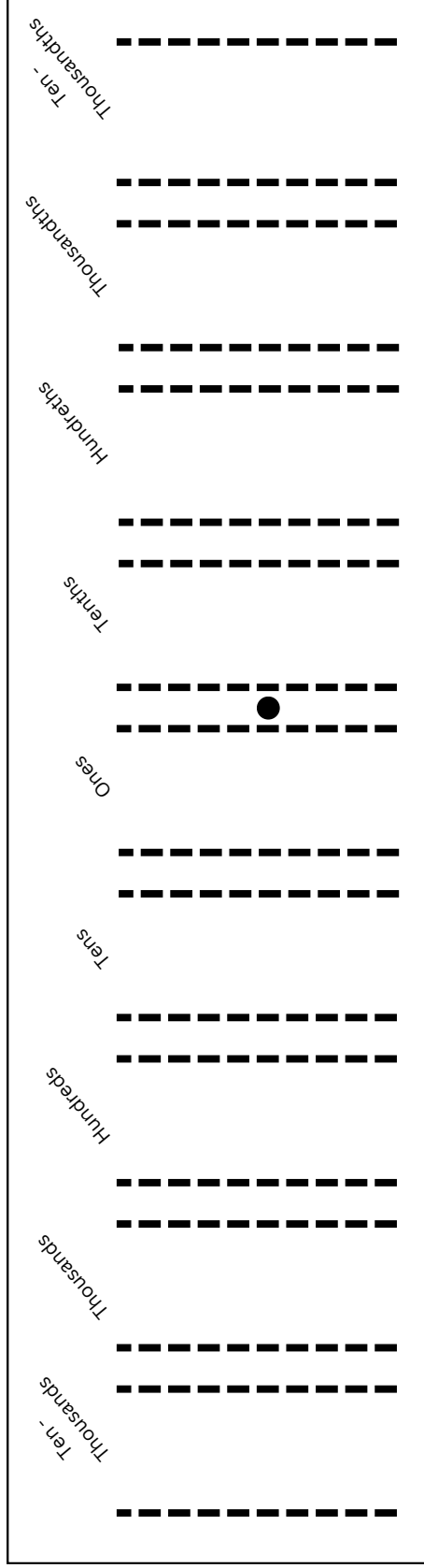
Reference: <https://extranet.education.unimelb.edu.au/SME/TNMY/Decimals/Decimals/teaching/models/numslide.htm>

NUMBER SLIDE MASTER

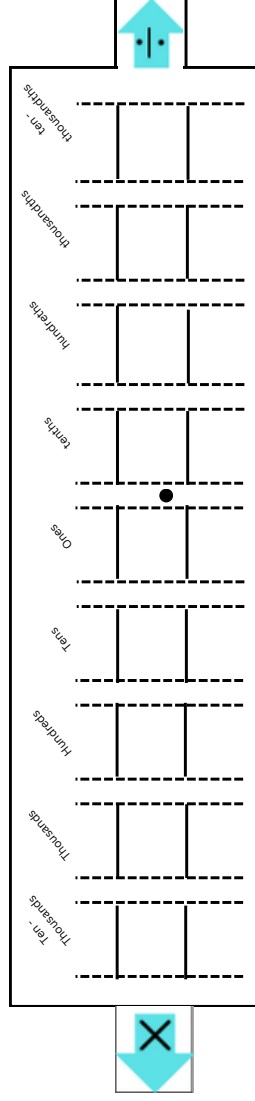
- 1 Cut and laminate this strip.



- 2 Cut the slide below. Laminate the slide and then make a slit cut along each dotted line.



- 3 Weave the strip through the slits until it looks like this.



*You can enlarge this template to make a larger Number Slide

99 or bust, is played with 2-4 players. The purpose is to encourage students to use efficient addition and multiplication strategies when calculating

Materials

- Dice 0-9
- 99 or bust game board for each player
- Whiteboard sleeve and marker
- Calculator

How to Play

Each player places their game board in their plastic sleeve. Player 1 begins by rolling the dice and deciding whether the number rolled should represent tens or ones e.g. if a 3 is rolled, player 1 must choose whether to choose 3 or multiply it by ten and choose 30. Encourage students to say "I rolled 3, I am multiplying it by ten to make 30" The number chosen is then added to that players total score.

The game continues with players taking turns to roll the dice, decide on what their number will represent, then add these numbers to their total.

Every player must have exactly 7 rolls.

The winner is the player closest to, but not over, 99.

N.B. This game can be differentiated by playing:

999 or bust, where a roll can represent ones, tens or hundreds

9999 or bust, where a roll can represent ones, tens, hundreds or thousands

0.99 or bust, where a roll can represent tenths or hundredths

0.999 or bust, where a roll can represent tenths, hundredths or thousandths

99 or Bust

Turn	Number Rolled	Amount to be added	Total
1			
2			
3			
4			
5			
6			
7			
Final Total			

PVAT

Place Value Assessment Tool
Form A

CLASS

before 88

HERE

P1

Place a number from
to order these numbers
to large

2
7
10
5

How many counters



P3

PVAT Form A

Form A of the PVAT is a paper and pen assessment used to measure student achievement in whole number place value.

- ✓ 4 practice items
- ✓ 58 items
- ✓ Valid and reliable measure of whole number place value in Years 2-6
- ✓ Addresses 6 aspects of place value
- ✓ Equivalent in difficulty to Form B

PVAT Administration Instructions

Follow these instructions when administering the PVAT Form A

Print the PVAT for your class

The PVAT is designed to be printed in colour or black and white.

Distribute the PVAT to your students

Students should not use calculators and should be given a maximum of 60 minutes to complete the test. The items are ordered from least to most difficult and are suitable for Year 2-6 students so encourage your students to attempt as many items as they can. They do not need to attempt all items, however those they don't complete should be marked as incorrect.

Assistance

Students should complete the test individually under test conditions. If a student requests your assistance you may read the item to them.

PVAT Marking Guide-Form A

Follow these instructions when marking the PVAT
Form A



Mark the PVAT

Use the guide on the following page to mark the PVAT.



Raw Score Translator

Use the Raw Score translator below to determine each student's PVAT stage of development. This translator is only suitable for Form A, there is a different translator for Form B.

Stage	Form A Raw Score (not including Practice items)
1	1 to 20
2	21 to 31
3	32 to 44
4	45+

Form A Answer Guide

Follow this guide when marking PVAT Form A
Do not include the 4 practice items. Total score is 58

Item	Answer Key	Aspect
1p	7	
2p	1,3,4,2 (written in boxes)	
3p	five	
4p	6	
1	14	compare/order
2	Seventeen (incorrect spelling is acceptable as long as you can read it as seventeen)	name/record
3	17	calculate
4	109	count
5	100	make/represent
6	8	rename
7	40	calculate
8	75	name/record
9	41	count
10	7000 or 7 thousand	calculate
11	1000	make/represent
12	45	make/represent
13	10	rename
14	345	rename
15	175	compare/order
16	10 tens or 100	calculate
17	8 or 8.9	rename
18	3827	count
19	10	make/represent
20	128,118,108,98,88	count
21	250	calculate
22	2,7,3,4,1,5,6	compare/order
23	56	rename
24	No	make/represent
25	3801	count
26	250	calculate
27	6	rename

28	Fifty four thousand and eighty-seven	name/record
29	6000	compare/order
30	3	calculate
31	2927	count
32	16 tens 7 ones	rename
33	12 yellow, 1 blue, 5 red or equivalent	make/represent
34	420	calculate
35	3 100 075	name/record
36	FALSE	rename
37	650	make/represent
38	324 or 324.567	rename
39	4600	compare/order
40	10	calculate
41	200 000	name/record
42	6800	compare/order
43	6 hundreds 84 ones	rename
44	1332	make/represent
45	150	rename
46	6 379 999	count
47	40 400	calculate
48	30 130	compare/order
49	343	make/represent
50	101 065	count
51	80950	calculate
52	733,852,971	count
53	44	compare/order
54	65 or 65.98	rename
55	1100	rename
56	600 000	compare/order
57	234 060	calculate
58	7800	rename

Collating your PVAT Data

Use an Excel Spreadsheet to collate your PVAT data



Mark the PVAT

Use the guide on the previous page to mark the PVAT.



Use the "PVAT Data Template" Spreadsheet

Input each student's PVAT Form A raw score and their PVAT Stage into a spreadsheet.

Name	Class	Pre Raw Score-Form A (out of 58)	Pre Stage	Post Stage
Example Student 1	4A	5	1	0
Example Student 2	4A	26	2	0
Example Student 3	4A	22	2	0
Example Student 4	4A	27	2	0
Example Student 5	4A	25	2	0
Example Student 6	4A	25	2	0
Example Student 7	4A	28	2	0
Example Student 8	4A	31	2	0
Example Student 9	4A	24	2	0
Example Student 10	4A	32	3	0
Example Student 11	4A	35	3	0
Example Student 12	4A	37	3	0
Example Student 13	4A	35	3	0
Example Student 14	4A	40	3	0
Example Student 15	4A	37	3	0
Example Student 16	4A	30	2	0
Example Student 17	4A	32	3	0
Example Student 18	4A	34	3	0
Example Student 19	4A	37	3	0
Example Student 20	4A	37	3	0
Example Student 21	4A	42	3	0
Example Student 22	4A	45	4	0
Example Student 23	4A	46	4	0
Example Student 24	4A	50	4	0
Example Student 25	4A	35	3	0
Example Student 26	4A	39	3	0

PVAT Stage	Colour
1	Red
2	Yellow
3	Blue
4	Green

Stage analysis

PVAT recommended stages at beginning of the year
(these are only guidelines)

Year Level	PVAT 'at risk' Stage	Enrichment
2	Further assessment needed	3,4,5
3	Low Stage 1 (<10)	3,4,5
4	1	4,5
5	1,2	5
6	1,2,3	Further assessment needed

Note: If a student scores less than 10 on the PVAT, you need to complete further assessments (for example the Pre-PVAT) to gather useful data on their current level of understanding.

These recommendations are based on the Years within the Australian Curriculum version 9.0



THANK YOU!

I hope you have found this session personally and professionally valuable!

If you have any questions please reach out.

Ange

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