Learning Difficulties Australia

Learning Difficulties Australia is an association of teachers and other professionals dedicated to assisting students with learning difficulties through effective teaching practices based on scientific research.

www.ldaustralia.org

@LearningDifficultiesAustralia

enquiries@ldaustralia.org

@LD_Australia

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Hi, I'm Erin Rollason

BSc, GradDipEd(Sec), MLI (SLD)
Learning Interventionist
LDA council member

I currently work at a very large mainstream, government secondary college in South East Melbourne. My leadership role encompasses Literacy and Numeracy interventions, with a supportive direction in positive learning for students with disabilities and SLD's.

Being neurodiverse, myself, I am passionate about providing students with disabilities and SLD's skills to ensure equity in the school context.

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Numeracy in Everyday Life for Secondary School Students

Objectives

To understand why percentages in everyday life are important.

To learn/revisit the language that supports the promotion of percentage knowledge in secondary school students with learning difficulties.

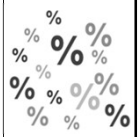
How to support percentage mastery at school and home.

3

Learning about percent is important-

"Percent is universal and because it forms a bridge between real-world situations and mathematical concepts of multiplicative structures".

Parker, M., & Leinhardt, G. (1995)



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Why is learning percentages important in everyday life?

- Adjust Medication safely
- Adapt recipes
- Understand battery life
- Affects lifestyle choices
- Saves time
- More employable
- Promotes financial literacy
- Interpret school grades
- Interpret sports statistics
- Interpret survey results
- Interpret weather forecast

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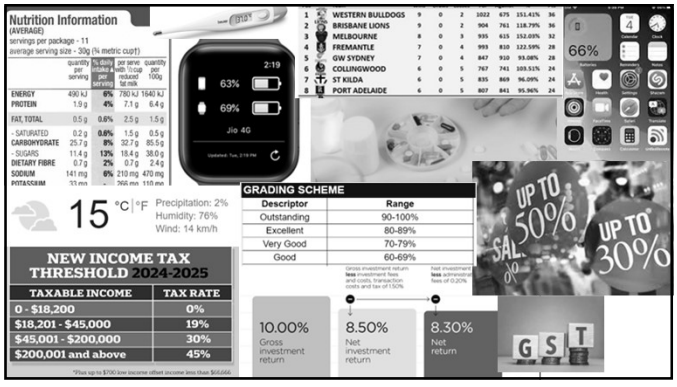

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Teach for meaning

Research supports learners with specific learning difficulties in Math, require support in not only the mathematical application, but understanding the language used to represent certain concepts and symbols.

Ronit Bird (2013), suggests that vocabulary should be varied when students are answering word problems. This is to encourage students to develop a habit of visualizing the scenario presented, rather than responding to 'cue words' all the time. For example, alternating words: take off, deduct, markdown, reduction, cut price, rebate and concession.

The aim of teaching percentages is for students to understand the logic and the language, that lies behind the calculation procedure, rather than a mechanical output of answers.

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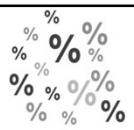
What is a percentage?

The word percentage comes from the Latin word "Percentum" meaning "by hundred", therefore, it is said that percentages are fractions with 100 in the denominator.

$$\frac{\text{is}}{\text{of}} = \frac{\%}{100} \text{ or } \frac{\text{part}}{\text{whole}} = \frac{\%}{100}$$

Percentage formula



A percent problem can have three values that are unknown:

1) **Part (='is')**
2) **Whole (='of')**
3) **Percentage (%) (over 100)**

e.g. What is 25% of 180?

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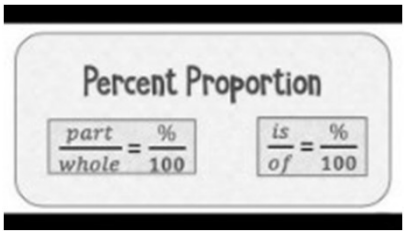
Percent proportion- worked examples



View - https://youtu.be/gnovvCttqZM

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What prior knowledge do percentages rely on?

Percentages rely on conversion rules for changing many mathematical concepts such as fractions to decimals, and mixed numbers to improper fractions. These rules present where the difficulty lies in learning percentages (Parker & Leinhardt, 1995). Thus, previous mathematical language is vital in promoting percentage knowledge and application.

Percentages also requires many conceptual steps based on concrete foundations in applying/ interpreting them (Bransford et al., 2000). If those previous skills have not been mastered, then one will find it very difficult to apply and interpret percentages correctly.

Decimal		Fraction		Percent
0.25	→	$\frac{25}{100}$	→	25%

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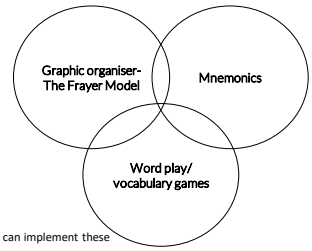
Evidence-based Vocabulary Strategies



Teachers, allied health and parents can implement these strategies

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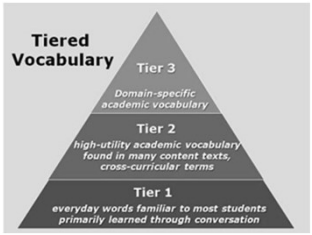
Language supporting the learning of Percentages.



Beck, McKeown, and Kucan (2002).

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Choosing supporting Vocabulary

Tier 1	Tier 2	Tier 3
Find	Discount	Denominator
Whole	Convert	Numerator
Base	Estimate	Fractions
Part	Calculate	Proportion
Increase	Quantity	Equivalent
Decrease	Amount	Percent
Difference	Reduction	Decimal
One hundred	Profit	Multiply
Loss	Symbol	Improper
	Value	Simplify
		Interest

Adapted from https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-7-10-resources/percentages

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Tier 1 words can still be tricky in math…

For example, consider the wording:

Similar words, different meaning.
'20% of fifteen dollars'
'20% off fifteen dollars'
← 'of' and 'off '

Placement of word, different construct.
Is 20% of 100, 5?
20% of 100 is 5.
← 'is'

Decoding for meaning.
What is 20% of 50?
10 is what % of 50?
10 is 20% of what?
← 'what'

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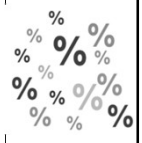
Why is percent so hard to learn?

"Understanding the privileged language of percent—an extremely concise language that has lost its explicit referents, has misleading additive terminology for multiplicative meanings, and has multiple uses for the preposition of."

Parker, M., & Leinhardt, G. (1995)



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Frayer model to build vocabulary

Frayer Model

Student Definition / Symbol (%)	Picture
Percent means parts per 100 **Percentage formula:** Part/whole x 100 = % **Percentage difference:** Difference/original x 100= %	 25%
Examples	**Non_Examples**
75 is 50% of 150 	Fractions 50/100 Decimals 34.78

Percent

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DEFINITION

A measure of the proportion of one whole, expressed as parts per 100.

CHARACTERISTICS

- Shown by the symbol %
- Equivalent to fractions with a denominator of 100.

Percentage

EXAMPLES

"Find 20% of ….

"Increase 37 kg by 2.6%"

"A sale takes 33% off…"

"Over its life, the height of a human increases by an average of 225%"

NON-EXAMPLES

0.3 ⅜ ¼

0.2356 1.4

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Mnemonic strategies

Mnemonic Strategy	Description
Keyword method	Students can use the keyword and a related sentence, image, or interactive picture to remember new information. This method is highly effective for students with disabilities and is flexible enough to be used in a variety of content areas.
Pegword method	Students can use common rhyming words for numbers (e.g., one = bun; two = shoe) and link these words to the information being learned. This method is especially useful for helping students remember numbered or ordered information.
First letter strategies	Students use the first letters of words in a list of items or steps to create another word (acronym) or sentence (acrostic). These strategies can be especially beneficial when students need to recall lists of information.

https://iris.peabody.vanderbilt.edu/module/ss2/cresource/q1/p04/#content

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Mnemonics devices- first letter strategy

https://www.mnemonicgenerator.com/

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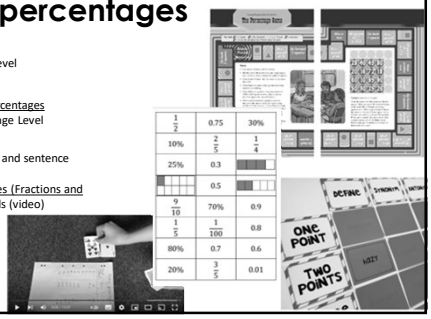
Game play- supporting learning percentages

Percentage game board- secondary level

Matching Fractions, Decimals and Percentages (matching cards). Age 7 to 14- Challenge Level

Jeopardy- define, synonym, antonym and sentence

Math Card Games: Picking Percentages (Fractions and Percentages)- Ollie Lovell Playing cards (video)



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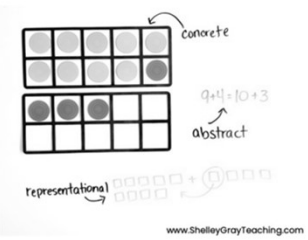
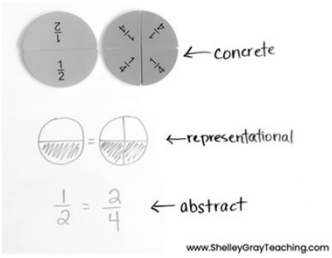
Supporting percentage understanding- CRA model





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Concrete materials

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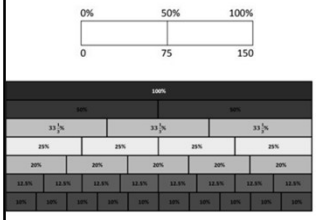
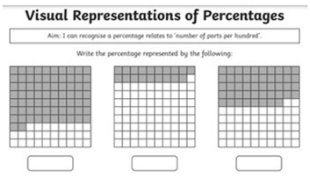
Representations of Percentages



Via TES



Via Twinkl.com

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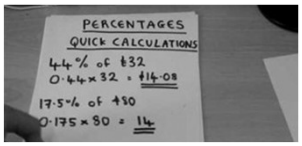
Abstract



$$30\% \text{ of } 20 = ?$$

$$= \frac{30}{100} \times 20 = \frac{30 \times 20}{100}$$

$$= \frac{600}{100} = 6$$

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Percentage in the curriculum – junior years (grade 6)

Level 6

'Number and Algebra'
- Make connections between equivalent fractions, decimals and percentages (VCMNA217) (Fractions and decimals (ACMNA131))

'Money and financial mathematics'
- Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies (VCMNA218) (ACMNA132)

'Statistics and Probability'
- Describe probabilities using fractions, decimals and percentages (VCMSP232) (ACMSP144)

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Percentage in the curriculum- middle years (year 7 and 8)

Level 7

'Number and Algebra'
- Connect fractions, decimals and percentages and carry out simple conversions (VCMNA247) (ACMNA157)
- Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. (VCMNA248) (Real numbers (ACMNA158))

Level 8

'Number and Algebra'
- Solve problems involving the use of percentages, including percentage increases and decreases and percentage error, with and without digital technologies (VCMNA276) (ACMNA187)

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Percentage in the curriculum- senior years (Year 11-12)

VCAA, VCE- Unit 1 (no percentages in Unit 2)

Foundation Maths-

* Area of Study 1 Algebra, number and structure

Includes: use of ratios, proportions, percentages and rates to solve problems.
- Area of Study 4; Outcome 1

Key knowledge on integers, fractions, decimals, ratios, proportions, percentages and rates

Key skills solve practical problems which require the use and application of a range of numerical computations involving integers, decimals, fractions, proportions, percentages, rates, powers and roots

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Percentage in the curriculum- senior years (Year 11-12)

Australian Curriculum- Unit 1

Essential Maths (Percentage)

* Calculate a percentage of a given amount (ACMEM011)
* Determine one amount expressed as a percentage of another (ACMEM012)
- Apply percentage increases and decreases in situations; for example, mark-ups, discounts and GST. (ACMEM013)

Unit 2- (Percentage calculations)

* review calculating a percentage of a given amount (ACMEM061)
- review one amount expressed as a percentage of another. (ACMEM062)

(Application of Percentages)

* determine the overall change in a quantity following repeated percentage changes; for example, an increase of 10% followed by a decrease of 10% (ACMEM063)

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Percentage in the curriculum- senior years (Year 11-12)

VCAA, VCE- Unit 3 and 4

Foundation Math-

- Area of Study 1- Algebra, number and structure

Key Knowledge:

- Ratios, proportions and percentages, direct and indirect variation
- Estimation and approximation including interval estimates, rounding, significant figures, leading-digit approximations, floor and ceiling values and percentage error.

Australian curriculum- Unit 3 (no percentages) and 4

Essential Math (**Probability and relative frequencies- Probablity expressions):**

*describe ways of expressing probabilities formally using fractions, decimals, ratios, and percentages. (ACMEM149)

(**Loans and compound interest):**

•* using percentages, rates and spreadsheets to investigate personal loan calculations

•calculating and analysing the costs, hidden traps, advantages and disadvantages of payment plans with interest free periods, using rates and percentages.

https://www.australiancurriculum.edu.au/senior-secondary-curriculum/mathematics/essential-mathematics/?unit=Unit+1&unit=Unit+2&unit=Unit+3&unit=Unit+4&page=2

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Percentage in the curriculum- senior years

VCAA, VCE- Unit 1

General Math-

* **Area of Study 1** Data analysis, probability and statistics

Includes a consideration of a range of distributions (symmetrical, asymmetrical), their summary statistics and the percentage of data lying within several standard deviations of the mean.

* **Area of Study 2-** Algebra, number and structure

-percentage increase and decrease, mark-ups and discounts, and calculating GST in various financial contexts

-the unitary method and its use in making comparisons and solving practical problems involving percentages and finance.

https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/generalmathematics/Pages/Index.aspx

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Percentage in the curriculum- senior years (Year 11-12)

National Curriculum- Unit 1 (no percentages in Unit 2)

General Math-

Unit 1- Consumer arithmetic (Applications of rates and percentages):

- review rates and percentages (ACMGM001)
- apply percentage increase or decrease in various contexts; for example, determining the impact of inflation on costs and wages over time, calculating percentage mark-ups and discounts, calculating GST, calculating profit or loss in absolute and percentage terms, and calculating simple and compound interest (ACMGM006).
- calculate the dividend paid on a portfolio of shares, given the percentage dividend or dividend paid per share, for each share; and compare share values by calculating a price-to-earnings ratio. (ACMGM008)

https://www.australiancurriculum.edu.au/senior-secondary-curriculum/mathematics/general-mathematics/?unit=Unit+1&unit=Unit+2&unit=Unit+3&unit=Unit+4&page=2

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Percentage in the curriculum- senior years (Year 11-12)

VCAA, VCE- Unit 3 and 4

General Math-

- Area of Study 1- Data analysis, probability and statistics

Investigating data distributions

Topic includes:

- the normal model for bell-shaped distributions and the use of the 68–95–99.7% rule to estimate percentages and to give meaning to the standard deviation; standardised values (*z*-scores) and their use in comparing data values across distributions.

Investigating association between two variables

Topic includes:

- contingency (two-way) frequency tables, their associated bar charts (including percentage segmented bar charts) and their use in identifying and describing associations between two categorical variables.

https://www.vcaa.vic.edu.au/curriculum/vce/vce-study-designs/generalmathematics/Pages/Index.aspx

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Percentage in the curriculum- senior years (Year 11-12)

National Curriculum- Unit 3 and 4

General Math-

Unit 3- Bivariate data analysis (Identifying and describing associations between two categorical variables):

* construct two-way frequency tables and determine the associated row and column sums and percentages (ACMGM049)
* use an appropriately percentaged two-way frequency table to identify patterns that suggest the presence of an association (ACMGM050)

- describe an association in terms of differences observed in percentages across categories in a systematic and concise manner, and interpret this in the context of the data. (ACMGM051)

Unit 4- Time series analysis (Analysing time series data):

* calculate seasonal indices by using the average percentage method (ACMGM090)

https://www.australiancurriculum.edu.au/senior-secondary-curriculum/mathematics/general-mathematics/?unit=Unit+1&unit=Unit+2&unit=Unit+3&unit=Unit+4&page=2

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Percentages are NOT explicitly taught in MATH METHODS nor SPECIALIST MATHS in the Victorian nor the National curriculum.

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Teaching percentages

- Use clear, simple, and concise language during explanations.
- Build up vocabulary terms and practice in a variety of real-life contexts.
- Repeat, repeat and repeat.
- Practice release of responsibility- "I do, we do, you do".
- Use visuals to supplement percentage concepts
- Use positive reinforcement.
- Recognise effort, rather that incorrect answers.
- Link percentages with the students interest i.e., shopping, sports etc.
- Encourage the student to teach what they have learnt to another student who is struggling (low stakes task) or get them to model what they would do.

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"We learn 10 percent of what we read, 20 percent of what we hear, 30 percent of what we see, 50 percent of what we see and hear, 70 percent of what we discuss, 80 percent of what we experience, and 95 percent of what we teach others."

- William Glasser (American Psychiatrist)

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What can be done at home?

What are percentages:
Math Antics

Finding a percent of a number:
Math Antics

What Percent is it?:
Math Antics

Percents missing total:
Math Antics

Percentages made easy - fast shortcut trick!
Tecmaths

Mental Strategies for percentages:
Percentage math trick 2 (mental percentages- explicit steps shown)

Eddie Woo (mental percentages)

Percentage Increase/decrease:
Eddie Woo (Percentage increase/decrease)

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Review

Percentages in everyday life is functional numeracy which is important as it has some many different impacts on one's self- financial literacy, health/lifestyle benefits, higher employment, saves time and allows for interpretation of lots of different data i.e., sports statistics.

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Percentage/ mathematical language is important when learning percentages, as it promotes word knowledge and comprehension in long worded mathematical problems.

Percentage mastery at school and home can be supported in many different way:
Unlocking percentage language (vocabulary), Frayer models-graphic organisers, Mnemonics, game play, and CRA model.

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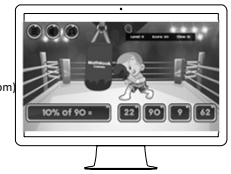
Helpful resources

Websites:
10 Common Uses Of Percentage In Our Daily Lives To Understand It Better
Number dyslexia here

Interactive games (free):
- 8 Cool Online Games For Understanding Percentages- Numberdyslexia
- Percentage games- Mathnook (younger, repetitive play)
- Converting fractions to percentage wall- Mathsframe (UK based, repetitive play)
- Percentage games- Math Games (a number of small games to chose from)
- Plan a Park game- involves planning a park with percentages.
- Fractions to percentages music is annoying (grade 6)



Percentage worksheets:
- Percent wall- TES
- MATHS Worksheets 4 kids- percentages
- Twinkl (create a free account)- lots of worksheets

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Useful curriculum percentage websites

Resources

Curriculum sites:

- VCAA website (f-10 Math)
- VCAA website (VCE Math) Units 1-4
- National Math Curriculum (f-10)
- National Math Curriculum (senior)

- Developing understand in Mathematic (Literacy Teaching Toolkit)

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Australian CURRICULUM

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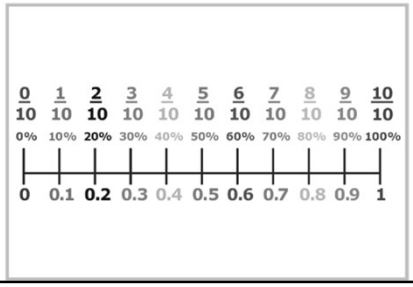
Useful visuals for percentage conversion



Via TES.com

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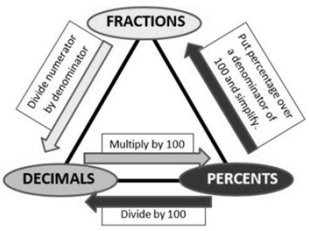
Useful visuals for percentage conversion



https://www.math-salamanders.com/fractions-decimals-percents-worksheets.html

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Useful visuals for percentage calculations- Percent Triangle Method.

Percent Triage Method watch- https://www.youtube.com/watch?v=CLyi9eysU2M

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Thank you

Questions?

www.ldaustralia.org

enquiries@ldaustralia.org

@LearningDifficultiesAustralia

@LD_Australia

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