Hampshire Services
HIAS SCHOOL IMPROVEMENT

Let's Talk About Words

Strategies for developing subect specific vocabulary in the classroom

Let's Talk About Words !

The programmes of study for mathematics, published in 2013, presents the national curriculum in England. It begins with an introduction that sets the scene and lays out the purpose of study and it's aims. One section of this is entitled 'Spoken Language' :

'The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum - cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.'

Many teachers find the most challenging part of teaching mathematics is around the area of reasoning. Many pupils are able to achieve procedural fluency with a range of written methods but find it very hard to answer the 'why' and 'how' questions. They know what they want to say, but a lack of precise mathematical vocabulary can often get in the way of a correct explanation or string of reasoning thoughts.

Communicating mathematically can be difficult even for pupils who appear to be performing well in the subject. The ability to communicate ideas and present them in a clear, purposeful manner requires a number of factors to be in place including a knowledge of vocabulary, flexibility, fluency with numbers, words, symbols, mathematical images and good comprehension skills. Research has suggested at least 11 categories of difficulty that pupils could encounter when learning mathematical vocabulary (Riccomini et all ;2015). These include:

- Meanings being context dependent (e.g. the possibility that foot could mean 12 inches or the bottom of the bed)
- Mathematical meanings being more precise (e.g. product meaning the solution to a multiplication problem or the product of a company)
- Terms being specific to mathematical contexts (e.g. polygon, parallelogram, imaginary number)
- Terms having multiple meanings (e.g. the side of a triangle or the side of a cube)
- Technical meanings that are specific to mathematics (e.g. cone as in the 3-D shape or something to put ice cream in)
- Everyday homonyms (e.g. Pi and pie)
- Terms that are related but different (e.g. perimeter and circumference)
- Challenges with translated words that have an everyday use as well (e.g. mega-, table)
- Irregularities with spelling (e.g. vertex and vertices)
- Concepts being verbalised in different ways (e.g. 45 minutes past or quarter to)

- Pupils and teachers using informal language rather than mathematical terms (e.g. diamond instead of rhombus)

(List taken from the MA magazine ‘Equals’ with thanks Equals25.3 (m-a.org.uk))

How can we support learners who face difficulties when learning vocabulary and language that is specific to mathematics ?

The HIAS maths team has produced glossaries for each key stage and a series of ‘word cards’ based on the ‘Frayer model’ to support teachers and pupils to develop the language of mathematics in the classroom.

The glossary is provided so that pupils can look up the meaning of words for their key stage with an example offered. It can also be of great use to teachers and other adults who perhaps need to check on the precise meaning or use of a word in a mathematical context. The glossary is structured so that the words appear in alphabetical order in each key stage but are referenced with the year in which they first appear in the national curriculum. This is designed to guide teachers as to what is considered age appropriate language for each year group.

At the back of each glossary is a list of ready-made word cards together with a set of printable blanks so that teachers and pupils can create their own.

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HIAS GLOSSARY FOR MATHEMATICS: KS 1

Word	Domain	Year	Meaning	Example
above	geometry - position and direction	1	A higher position than something else	I put the box on the shelf **above** the desk
addend	addition and subtraction	1	A number to be added to another number	8 + 3 = 11 14 + 21 + 8 + 0 = 43 3,8,14 and 21 are all **addends**
addition	addition and subtraction	1	The operation to combine two or more quantities to form another quantity (the sum or total). Addition is the inverse of subtraction and can be denoted with the symbol '+'	addend + addend = total (sum)
after	measurement	1	A period of time describing one event following another. A description of the position of a number or object in a sequence	We have lunch **after** our morning lessons
afternoon	measurement	1	A period of time describing the time after noon, midday, until the evening (often sunset)	After lunch we have lessons in the **afternoon**
altogether	addition and subtraction	1	The sum or total of a set of objects or quantities	I have 8 counters and you have 3, we have 11 counters **altogether**
amount	measurement	2	A quantity of something	I have an **amount** of counters
analogue (clock)	measurement	2	A clock that shows a 1-12 clockface	

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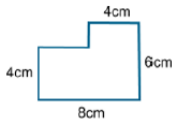
HIAS GLOSSARY FOR MATHEMATICS: UPPER KS 2

common factor	multiplication and division	5	A number which is a factor of two or more other numbers.	3 is a **common factor** of the numbers 9 and 30
common multiple	multiplication and division	6	An integer which is a multiple of two or more other integers.	24 is a **common multiple** of 2,3,4,6,8 and 12
complement (of a number)	addition and subtraction fractions, decimals, and percentages	5	Pairs of numbers that sum to another number (number bonds)	67 + 33 = 100 67 and 33 are **complements** in 100
composite number	multiplication and division	5	A whole number that is the product of other whole numbers, excluding 1. This means that 1 and prime numbers are not composite. A composite number has more than two factors.	2 x 6 = 12 and 3 x 4 = 12 12 is a **composite number**
composite shape	geometry-properties of shapes	5	A shape formed by combining two or more shapes.	
compound unit (speed)	measurement	6	A measure with two or more dimensions is a compound measure. Speed is calculated as distance ÷ time.	The car travelled at 50 km/h The speed is given in kilometres per hour
conjecture	reasoning fractions, decimals, and percentages	6	An educated guess (I) of a particular result, which is as yet unverified	2,4,6,8,10….. **Conjecture**: The next number will be 12 because the sequence goes up in 2s

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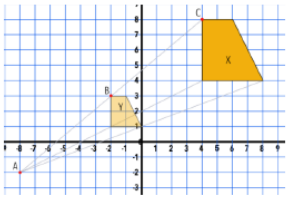
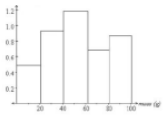
HIAS GLOSSARY FOR MATHEMATICS: KS 4

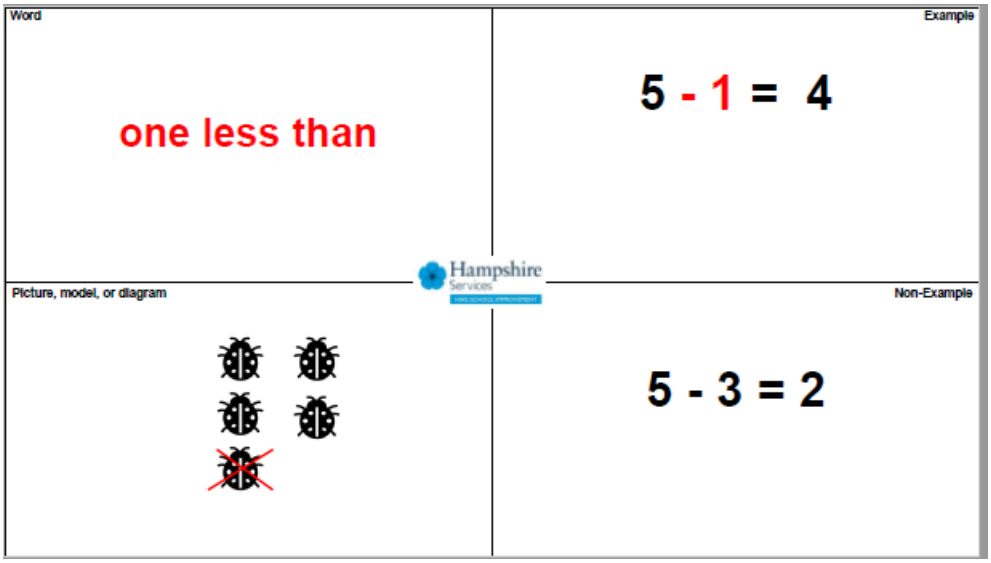
fractional (scale factor)	geometry and measures	9+	A scale factor of enlargement between zero and 1 that produces a smaller image from the original object e.g. half the size. In cases where the fractional scale factor is an improper fraction (i.e. greater than 1), the enlargement will be larger than the object e.g. 3/2 will give an image 1.5 times the size of the object.	 The small trapezium (Y) is an enlargement, scale factor ½, of the larger trapezium (X). Centre of enlargement (-8, -2)
fractional indices	number	9+	Fractional, positive, exponents (indices) represent roots.	$16^{1/2} = 4$ ($\sqrt{16} = 4$)
frequency density	statistics	9+	A scale on the y-axis of a histogram, usually with unequal class widths. It is the area of the bar that tells us the frequency in a histogram, not its height. Instead of plotting frequency on the y-axis, we plot the frequency density. To calculate this, you divide the frequency of a group by the width of it.	 The **frequency density** is plotted on the y-axis

The word cards can be used in a variety of ways in the classroom. For example:

- Ready-made completed examples can be displayed on a topic or working wall
- A word can be given, and pupils can discuss and decide on an example and a diagram of what the word is, and an example of what the word is not.
- A diagram can be shared, and pupils decide which word is being illustrated (this encourages rich discussions, particularly if the diagram is a bar model!)
- The example or the non-example can be offered, and pupils can agree on the word that best describes this.
- A set of ready-made completed examples can be cut up into four sections and used as a matching and discussion task. This could be topic based or a mixture of words and meanings to support recall and retrieval from a previous week, term or year.

However you teach subject-specific vocabulary in your classroom, it is important to consider the difficulties that your pupils may encounter with double meanings, linked symbols and images , unusual spellings, words not in everyday use, words in everyday use that have a different or parallel meaning and so on. The value of group discussions that encourage your pupils to co-construct and agreed understanding of what a word **is** and what a word **is not** is a vital component to their success in communicating their understanding and reasoning in mathematics.

Jo Lees



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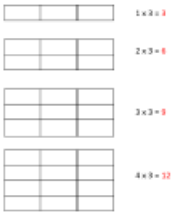
Word	Example
number	8
Picture, model, or diagram	**Non-Example**
	A

Word	Example
ones	5 *Five ones*
Picture, model, or diagram	**Non-Example**
H T O 5	20 *Two tens*

Word	Example
multiple	**3,6,9,12** These are the first four multiples of 3, they are all in the 3x table
Picture, model, or diagram	**Non-Example**
	**4,7,10,13** This sequence goes up in 3s but the numbers are not in the 3x table

Word	Example
sum	**342 + 87 = 429**
Picture, model, or diagram	**Non-Example**
429 342 | 87	**342 – 87 = 255**

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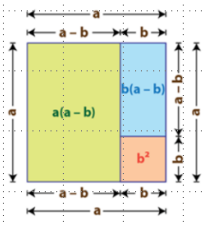
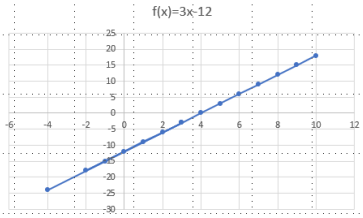
Word	Example
integer	**-15 , 7 , 43** **are all integers**
Picture, model, or diagram	**Non-Example**
Integer Number Line negative integers positive integers -4 -3 -2 -1 0 1 2 3 4 Zero is neither positive not negative	**0.5 , -6.2 , 81.9** **are not integers**

Word	Example
identity (≡)	$a^2 - b^2 \equiv (a + b)(a - b)$ $(a - b)(a + b) = a^2 + ab - ab - b^2$
Picture, model, or diagram	**Non-Example**
	ab ≈17

Word	Example
function	$f(x) = 3x - 12$
Picture, model, or diagram	**Non-Example**
	$3x - 12$

Word	Example
Picture, model, or diagram	**Non-Example**

HIAS Maths Team

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