Twelve Challenges to get students thinking

Challenge in the classroom fulfils a plethora of different important functions. Challenge pitched at the right level is a fantastic motivational trigger which can get learners into what Csikszentmihayli refers to as 'flow'. So immersed in their learning that the teacher is usually left standing idly by considering for once what a great job this really is! Flow necessitates an appropriately complex challenge that the learners work on independently. It often requires learners to work collaboratively, promoting high quality discussion and teaching of others amongst learners.

Many of the teachers we have worked with have struggled to improve the quality of questioning asked by both themselves and their learners until they re-considered the level of challenge that the lesson provided. Until learners are working up Bloom's taxonomy applying, analysing, evaluating and synthesising then the quality of questioning tends to be closed in nature and overly focussed on knowledge. The presence of a 'pit' creates fertile opportunities for rich learner-learner questioning as well as allowing teachers to morph into educational Paxman-ites probing the answers of learners for opportunities to expose inconsistency or providing contrary evidence to increase the cognitive confusion further. Consequently questioning provides a powerful AfL role far beyond the limitations of traffic lights and thumbs up/down. Such feedback can accurately inform planning as well as providing the learners themselves with clarity about what level they are working at, what they need to do to move up a level. Without challenge, it is difficult to establish the extent to which learners fully understand the new learning presented and therefore the effectiveness of teaching and learning taking place.

In many classrooms, learning and progress are inhibited by the fixed mindset of some learners, whose internal dialogue is framed around "I can't". We passionately believe that nurturing growth mindsets is crucial to the long term success of these young people in life as much as whether they achieve their target grade on the next module they sit. The best way to achieve this is through creating situations in lesson where learners get themselves and others out of the ' pit' thus creating those 'Eureka' moments where they begin to realise that effort and different strategies can actually increase their own intelligence rather than it being fixed.

Finally, just in case you are not quite convinced, a lesson without a 'pit' is one that prevents the learning from being graded anything more than a 3 on the Ofsted grading criteria. HMI have commented that it is possible to grade a lesson by looking solely at the lesson plan. Without a 'pit' there is little opportunity for learners to demonstrate good or exceptional progress or for high quality AfL to take place.

Here are a range of generic tools that can bring more challenge into the classroom. All have been seen to work effectively to get learners thinking more deeply about their learning. They are tools that have been seen to work in all year groups both at primary and secondary and in a range of different subjects. Why not look through one of your schemes of work and see where you could level up challenge by using one or more of these frameworks. For each challenge there is an explanation of what they are, how to use them, how they challenge the learners as well as a list of possible (though not exhaustive) applications across the curriculum.

1. Mysteries

Getting students to use newly acquired skills or knowledge to solve a murder or crime baffling detectives.

Mystery games help students to learn through the discovery process. Information is distributed to each of the students in a series of clues. The process of pooling of information is required for solving the mystery or mysteries.

A mystery game can be a broken information exercise which engages students and develops skills of analysis, empathy, oral communication and listening. Students are given pieces of information from which they have to solve a mystery. Alternatively the students could use newly acquired skills/knowledge to solve a mystery.

Students of all ages tend to enjoy mysteries especially when they are a bit gruesome! George Orwell commented that a typically British trait is to enjoy reading about a "juicy murder". These mysteries can be thought-provoking, challenge stereotypes and fun.

Examples of Mysteries in action
- Which country is the murderer hiding? – geography mystery.
- Why is the Maori boy crying? – again a geography mystery to explore racism and inequality in New Zealand.
- Who killed our plant? – biology mystery exploring what plants need to grow.
- Leaving the outcome ambiguous enables learners to come up with different theories that lead to the truth.
- Science has a long track record of using mysteries where learners use scientific techniques e.g. soil sampling, colour chromatography etc to analyse different pieces of evidence.
- One Yr12 health and Social Care lesson used a mystery surrounding neglect of an elderly person.
- Skilfully designing the mystery can ensure that learners practise particular skills they have been taught in a previous lesson e.g. Maths lesson where learners used clues about speed/distance/time to identify which of the suspects could possibly have been at the murder scene at the time. A Yr3 numeracy lesson saw the children use the answers to set questions to uncover a code that identified clues about the suspect. The mystery was who had eaten the cake in the headteachers' office? (see below)
- What's happening in the photo/video clip that links with your learning?
- Why has the company gone bankrupt? Business studies
- Maths teachers at KS4/5 try this wonderful book where they are written for you! Mathematical Team Games – Vivien Lucas (Tarquin Publications)
- Still struggling for ideas? One English teacher in a Yr7 lesson simply took the plot from a Roald Dahl story, changed the names and 'bingo!' there was a perfectly constructed mystery.

2. Venn Diagrams

You may think of this as a maths specific resource, how wrong could you be. Venn diagrams are a great tool to get students to explore the differences and similarities between concepts and think more deeply about the properties of the concept. This can be applied with Early Years children up to Yr13.   For extra complexity additional circles can be added.

They can be used in two different ways. Either give the students cards containing key words or evidence that the students have to correctly place OR get the students to come up with examples to fit into the different categories. Remember the area outside both circles represents those things that do not share any of the properties of either circle.
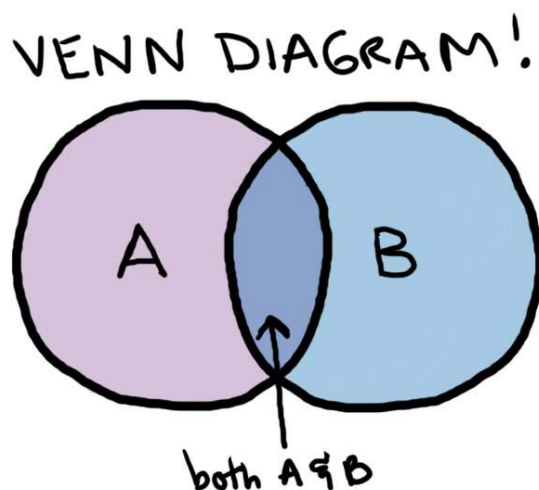
Examples of Venn diagrams in action

- English to compare/contrast genres, characters, or themes
- history to compare/contrast events, individuals or countries
- business studies to compare/contrast cash flow and profit in business studies
- Early Years to allocate items to different people e.g. boys and girls possessions or items to characters in a story
- Any classification topic in science

The activity could be given additional complexity by providing more evidence that may mean students need to re-appraise their answers.

3. Map from Memory

This activity works as an excellent activity to recap prior learning either to start a lesson or as a revision activity. The activity does exactly what it says. Students are put into groups of 3-5. Each student in the group is given a number. Then the teacher calls up all the students with number one. These students have got 30secs to study a mind map/diagram or map of a topic. They have to memorise as much of what they see before they return to their group to explain what they can remember to the rest of their group. Another member of the group then reproduces this on the team's large piece of paper.

The process is then repeated with the number 2's going up and so on.

This activity promotes talking and listening amongst students as they try to plug the gaps in terms of content on their own map.
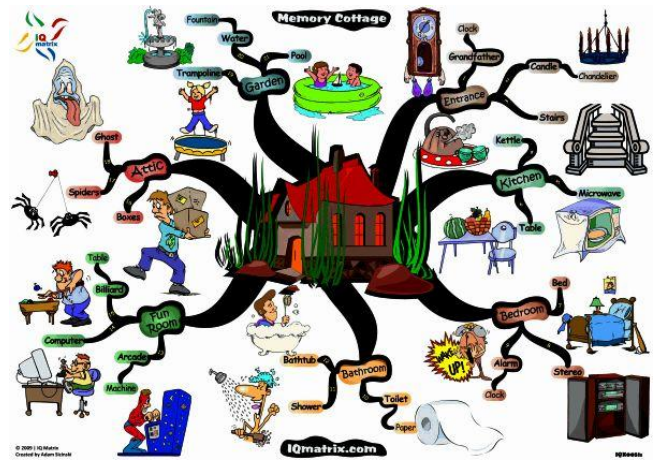
4. Odd one Out

The process of identifying the properties of things and classification lies at the heart of odd one out. This can be as a class, individual or paired activity. The strength of the activity is that it promotes discussion and exploration of the properties of things. It could work well as part of a starter or plenary activity

Additional complexity can be built in by including multiple possible answers to create uncertainty and tension in the minds of students.
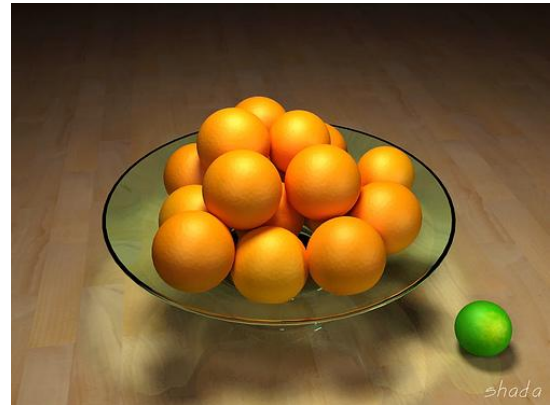
For young children; actual objects from home or school could be used. Alternatively they could come from a story they are familiar with. Alternatively it could be as simple as duck – frog – cat!

You might also incorporate
Get the learners to identify the odd one out and then challenge them to add another item to the set so that the odd one out remains the same.
Some teachers have given the task of creating odd one out challenges for homework so that the learners can test each other in the next lesson. Could you get your learners to create these challenges for others?
As learners develop, more ambiguity can be designed in so that the learners could possibly identify more than one odd one out or add an additional item which does not change the odd one out. Additional complexity can be built in by including multiple possible answers to create uncertainty and tension in the minds of learners.
Three objects can be increased to three columns of objects (four to four columns) and do the same thing choosing different rows – up/down, across, diagonal etc.

Examples of Odd One Out in action
For very young children, identifying the odd one out from three/four objects can be a really engaging challenge where there is more than one possible answer. It is also a great way to develop the language e.g. simple numbers, shapes, characters from a story, animals, clothes for different seasons. They could use actual objects from the classroom, home or objects from a story.

5. Sequencing / Ranking / Sorting / Classifying

This is a great way to get students discussing, analysing, and evaluating. Giving them a list of items and getting them to rank / sequence / classify or sort them into the 'correct' order. Actually building in ambiguity can ensure that different groups get different orders and actually appreciating that there may be more than one acceptable answer.

The information on each card could be a key word or an idea. Alternatively with younger children perhaps pictures would be used instead.

Examples include:

Sequencing
- the stages in processes in science / geography / business studies
- stages in events in history / novels in English

Ranking
- relative importance of different factors /events / individuals

Sorting / Classifying
- items into groups with similar characteristics

Examples of Sorting and Classifying in action

The exemplar below is a set of cards associated with acids and alkalis. The cards can be subdivided beyond those related just to acids or alkalis.

Child cries because they got soap in their eyes	Litmus unaffected
NaCl	David unblocked the drains with strong bleach
Water	Stomach digesting food
Rust on cars	PH7
Bleach	NH_3NH_4OH
Indigestion	PH 10
Bitter taste	NaOH
Milk of magnesium	Turn litmus blue
Often react with metals to leave a salt	Batteries
Vinegar	Lemon juice
PH2	Oven cleaner
Tooth decay	Can burn the skin
Baking powder	Sour taste
Turn litmus red	Soapy to touch
H_2SO_4	Black coffee
PH2	HCl

6. Living Graphs

What is it?

This is an extension of fortunes lines above where the learners are presented with a pre-prepared graph and axes. They have a set of statements which relate to one or more stages on the graph. The challenge for learners is to correctly assign where the statements are most likely to have occurred.

Why use Living Graphs?

Living graphs works well in getting learners into the pit and prompting higher order thinking. They help learners to relate the abstract data to real contexts thus. They create valuable opportunities to get learners discussing and disagreeing with others and through this, learners demonstrate a deeper understanding of the concepts the graph is representing. Furthermore using statements which have real-life characters, brings a relevance to an otherwise abstract graph.
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How to use Living Graphs?

Create a series of statements relating to people or events linked to the graph you are giving the learners. This will enable the learners to connect to the data in the graph.

The more able the students, the greater the need to ensure that some of the statements are ambiguous and can therefore be placed on more than one section of the graph. Similarly increasing the number of statements as well as providing some blank cards so that the learners can create their own statements provide increased challenge.

Get learners working in pairs on this, then they can compare their ideas with those of another pair.

Examples in action

- Recounting through sequencing the events from a school trip using photographs and statements (Yr4)
- Anywhere on your scheme of work where data could be incorporated into graphs (bar, line etc).
- Blood sugar levels during the course of a day
- Weather and seasons
- Cycles in science and geography
- This idea can be adapted to use with charts and diagrams where a change takes place over time e.g. stages in volcanic eruptions

7. Concept Mapping

This tool aims to get students to examine the relationships between different concepts in a topic or subject area. This aims to get students to develop better synthesis. The students should be encouraged to explore cause/effect relationships, two way relationships and label the links between concepts. Students should be encouraged to talk either to peers or teacher about the reasons for their choices.

To use concept mapping, give small groups of students a list of key terms or concepts and get them to map them out on a large piece of paper drawing arrows to identify relationships between them.

This has such wide application in all subject areas as either a plenary activity or at the start of a topic to identify prior learning.
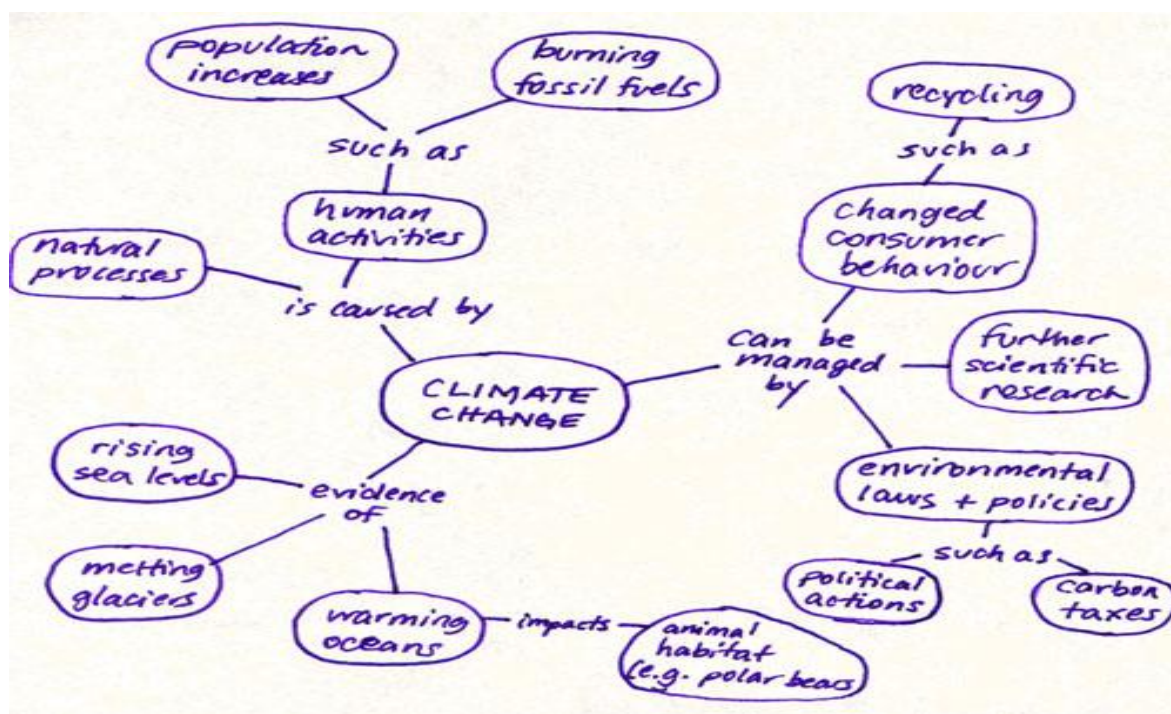
8. Compare and Contrast

Comparing and contrasting has been found to improve students understanding of the topics compared by much more than one grade. It is a preferred method for helping students to clarify concepts that are often confused, or poorly understood.

Students are put in pairs or small groups, and are given a grid like the one below (only <u>much</u> bigger!) on flip chart or A3 paper. They work in groups to make a bullet pointed list of important similarities and differences between the two concepts. They can work from previously unseen, or from other notes to do this. Clearly this could be used in any subject to help teach almost any pair of similar concepts. For example:

Fractions and Percentages

Charles I and Charles II relations with Parliament

Osmosis and diffusion

Shares and Bonds

Commas and semicolons

Characters in a novel

	Similarities	
Comparing Kinetic Energy and Momentum	**They both:**	
	Differences	
	Kinetic energy… But Momentum…	*Momentum… But Kinetic energy…*

9. PMI - An Edward De Bono created method of decision making.

| Plus	Minus	Interesting

The benefit of this approach to thinking is that it forces students to consider both sides of an idea not just the one they initially favour. Setting the class a challenge of working in groups to come up with 3-5 positive and negative (minus) points along with 2-3 interesting points provides a framework to force them to think more deeply about the issue. Some of the groups can be given the task of only considering one or other side of the argument. This tool can prove to be very productive in preparing students for writing essays.

It would be a good idea to model the process first with a practice example such as "Social networking sites should be banned for everyone under the age of 18."

10. Diamond Ranking

Understanding how to set priorities by asking "how important is this?" is an important skill. Diamond ranking challenges students to work together to discuss and make judgements about the relative importance of different items. Set a question and have nine ideas for students to prioritise. Write each idea on a post-it note and ask each group to arrange their nine ideas in a diamond shape with their top priority (or best solution) at the top, two in second place, three in third place, two in fourth place and the lowest priority (or worst solution) at the bottom. They need to get consensus as a group and can move the ideas around until they reach an order with which they all agree.
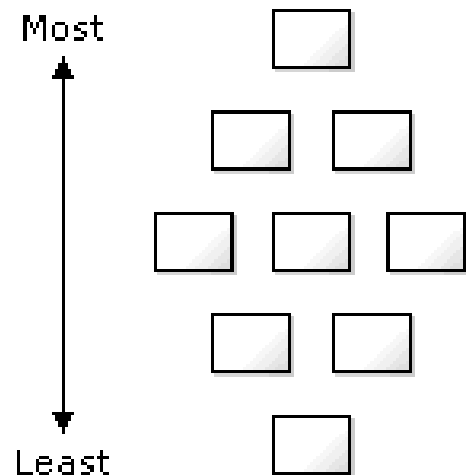
Examples in action

- Different foods in order of healthiness (Food Tech)
- Activities a person might do (literacy)
- Factors influencing a character in a novel (English)
- Factors affecting a business location for a firm (geography. Business studies)

11. Quick on the Draw

A research activity with a built in incentive for team work and speed
This is a straightforward race between groups. The aim is to be the first group to work its way through a set of questions.

1. Prepare a set of, say, ten questions about the topic in hand. Copy enough set for each group to have its own. Each question needs to be on a separate card.   Each set of questions needs to be in a distinctive colour. Put the sets out on the teacher's desk, numbers facing up with number 1 on the top.
2. Divide the class into groups of three (fours if necessary, although this invites passengers). Allocate a colour to each group so they can identify their set of questions on the teacher's desk.
3. Give each group source material that contains the answers to all the questions – one copy per student. This could simply be selected pages from the regular textbook. The answers shouldn't be too obvious: the idea is for the students to have to search the text.
4. At the word "go", one person from each group "runs" to the teacher's desk, takes the first question only of their colour and runs back with it to the group.
5. Using the source material, the group finds and writes down the answer on a separate piece of paper/mini whiteboard.
6. This is taken to the teacher by the second person. The teacher checks the answer. If it is accurate and complete, the second question from their colour pile is collected.... and so on. If any answer is inaccurate or incomplete, the teacher sends the runner back to the group to try again. Writers and runners should rotate.
7. While one student is "running" the others be scanning the resource and familiarising themselves with its contents so they can answer future questions more efficiently. It's a good idea to make the first couple of questions fairly easy and short, just to get momentum going.
8. The first group to complete all their questions "wins".
9. You then go over all the answers with the class and written records are made.

Examples in action

- **Maths:** each card can be a separate problem, or each card can be one step in a series that leads to the completion of a more complex task. This trains students to check that each stage of a process is correct before moving on to the next.
- **English, Humanities, PSHE, Business Studies**: the source could be text, pictures, artefacts.
- **Modern Foreign Languages:** the source material could be text such as a story, making the activity a straightforward comprehension exercise. Or the material (or the questions) could be pictorial. Or it could be an exercise in sentence construction, matching one half with the other, or simply an exercise in collecting new vocabulary.
- **Study Skills:** debrief the range of skills used in the exercise, including skim-reading, scanning, close reading, key-word identification, collaboration; and the ways in which students can organise more effective resource-based learning in future.

Why do it?

- The activity encourage team work – the more efficient the team work, the fast the progress. Groups learn that dividing labour is more productive than duplicating labour.
- It gives experience of a variety of reading skills, driven by the pace of the activity plus a host of other independent learning and examination skills – reading the questions carefully, answering the questions precisely, distinguishing between crucial and the peripheral material.
- The exercise helps to get students used to basing their learning on resources other than teacher.
- Suits learners with a kinaesthetic disposition who can't sit still for more than two minutes!

Variations

1. Can be played as a race against the clock, rather than against other groups.
2. Alternatively, the activity does not have to be competitive at all groups can check answers with each other to ensure detail and thoroughness.
3. Groups can collect visual pieces to build up a finished picture. For example, in GCSE PE pieces of skeleton can be collected to build up a whole body. Each of the pieces can be named and a question about is function or vulnerability in sport answered before the next piece can be collected.
4. A short cut: instead of copying a set of questions on card for each group, the teacher whispers the question to each runner as they come out.
5. The questions could be graded: the first ones deal with essential information (must), the next few embellish or deepen understanding (should), the final ones "extend" understanding (could).
6. Rather than all groups having the same questions, each group could have its own. If the groups are carefully composed by the teacher, this enables learning to be differentiated to a very precise degree.

Source: Paul Ginnis 'The Teacher's Toolkit'

Marketplace Activity

What is it?
Students will produce information at their "stall" for other students to visit and get information. This information will be presented in poster form and will be very 'visual'. This is an excellent activity for engaging both sides of the brain and utilises many learning styles.

Organisation

- Organise students into groups of three.
- Give out the leaflets and other information on the particular topic. Each group is to be given a particular topic or aspect of the topic to research. They will also need a large piece of sugar paper/flipchart paper and a variety of thick coloured pens.
- Write up the sequence and timing of stages on the board or OHP. This exercise is conducted through a series of strictly timed stages. Making the timings explicit will help the students.
- Main activity - Each group is to research the chosen/given topic or concept and is given a time limit for this (e.g. 25 mins). The group should use the sugar paper and are told that they can only use a maximum of 10 words on the page and instead have to use drawings, symbols, numbers, cartoons, diagrams etc. This will help the pupils to translate written information from the information into visual information on their page. All of the group should play a part in producing the poster.
- When the time limit is up, one member of the group will stay with their 'poster' and be the market trader. They will have to convey the information from their poster to other students in the class, mainly by verbal communication. All of the other members of the group will then go and visit other market traders who have information on the different careers and they are allowed to write down the information they receive on a piece of A4 paper.
  Suggested time limit for this – (10 mins.)
- Each group then comes back together and they feedback what they have learned from the other market traders to the rest of the group. This encourages verbal communication skills between the groups.
- To assess their knowledge in the group you could then have a quiz where each team is competing with other. If the market trader is able to answer a question without having to confer with the other group members they will receive more points than if a group member has to help. This will also increase competition between the different groups and hopefully encourage better communication in the feedback of the information about the topics/concepts.
- At the very end the teacher can go through any questions that the students found difficult or have got wrong. For each of these tough questions the teacher asks volunteers to have a go at the answer. In the last resort the teacher gives the answer.

Examples in action

Business Studies: different types of businesses; different theories on motivation.

English: different characters in a book or play; different stanzas in a poem, different chapters or scenes; different parts of speech; different influences on a writer.

Technology: assessing different materials; evaluating different products.

Maths: revising different topics; learning new procedures and methods.

History: examining different causes of a conflict; comparing and assessing various primary and secondary sources.

Geography: comparing different cities; the causes and /or effects of urbanisation.

PE: demonstrating different warm-ups; different techniques explored.

Art: the essential characteristics, with examples of the history of art; different artists; different painting techniques.

Source: Paul Ginnis 'The Teacher's Toolkit'