

Building the habit of...

Reasoning



The New Challenge

Ofsted now recognises the need for schools to:

- provide their own compelling data of a trajectory of improvement
- successfully promote and support children's 'self confidence, self awareness and understanding how to be a successful learner'.

This together with the current interest in character led education all point to the opportunity for schools to cultivate the habits and attitudes that underpin success and thereby build students' learning characters.

About Learning Habits and Character

Learning habits are the routine ways in which we think and act when faced with life's experiences and challenges. They are second nature to us. Some habits make us very productive and effective; others cause us to learn in constrained and limited ways. Habits are indeed part of our character.

We acquire habits through use: ways of behaving become habituated. If we have a well formed **Reasoning** habit, we will have a tendency to use it in all learning experiences. The more we experience the value of a particular habit, the more we will tend to use it throughout our lives.

Like it or not, teachers do help to form a learning character. The ways in which young people perform and behave are influenced by the way teachers orchestrate and guide learning. Deliberately fostering an effective learning character in students is a renewed common purpose for education, shared between students and teachers, parents and society more generally.

A well formed **Reasoning** habit involves being **ready, willing, and able** to:

Resist jumping to conclusions, seeking justifiable evidence to shape sound, well-honed arguments.

Generate hypotheses, scrutinise their assumptions, make predictions, seek evidence and counter evidence, look for false steps and carefully draw conclusions.

Remain suspicious, doubting and self-doubting in order to avoid unwarranted certainty.

Use appropriate tools to assist reasoning and help solve problems. These may include: compare and contrast, pro and cons, cause and effect and playing devil's advocate.

Convey their logical thinking clearly, through dialogue, symbols, analogies, prose and pictures.

Use logical thinking to establish the value or otherwise of an idea, concept or proposal.

“**Mathematics is, in its way, the poetry of logical ideas.**”
– Albert Einstein

Young people with the habit are likely to:

Ask 'Why'

Enjoy problem solving

Look for evidence-based answers

Think before they act

Be persuaded by clear, evidence-based, arguments

Want reasons and proof

Question their intuition

Work methodically

Look for flaws in arguments

Think of pros and cons

Quick Wins

Brain Teasers

- » Use brainteasers to stimulate logical, deductive reasoning. For example:
 - » Marie, Claude, and Jean are in a competition. Here are their results:
 - » The youngest person received the least points.
 - » Claude got half of the points of the eldest.
 - » Jean received as many points as both others combined.
 - » Who is the eldest?
- » In the debrief, focus in particular on how the problem was solved, rather than on the correct solution. See www.sharpbrains.com/teasers

Code Breaking

- » Present students with coded messages and require them to work them out using their deductive skills.
- » Start with simple substitution codes where, for example, each letter is replaced by the one after it in the alphabet. (*i.e. b replaces a, c replaces b etc. etc.*) Increase difficulty by using more complex ciphers.

Odd One Out

- » Identifying similarities and differences is one of the most powerful learning skills since it requires students to notice detail, distil information, make links, and use their reasoning skills in order to spot the odd one out.

Strategy games

- » Use games that require strategy and logical thinking. From noughts and crosses to chess, from hangman to backgammon, such games help to develop and refine reasoning skills. Many appear in the form of maths investigations and problems: Frogs; Tower of Hanoi; Nim; Connect 4; etc.

Forming the habit

activities to develop... Reasoning

Visible thinking routine

What's happening here?

What makes you say that?

This is one of many visible thinking routines to be found on the visible thinking website www.pz.harvard.edu/vt/

The first question in this routine is flexible: it is useful when looking at objects such as works of art or historical artifacts, but it can also be used to explore a poem, make scientific observations and hypotheses, or investigate more conceptual ideas (*i.e.*, democracy).

The routine invites students to describe what they notice, see or know and asks them to build explanations. It promotes evidence-based reasoning and when the students share their interpretations it encourages them to understand alternatives and multiple perspectives.

Sequencing

Cut up a cartoon, or series of pictures of a production process, or a flow diagram, or a mathematical proof, or a story line, or a musical score, or a poem, or a sequence of events, and so on. Ask students to reassemble the pieces in what they think is a viable order and explain their reasons for this. Model and listen for the language of reasoning to strengthen the process.

Lift the level of challenge by omitting one or two of the pieces, or by including a red herring or two, or by interleaving two sequences that need to be separated before the sequencing can be completed.

Ranking

Give students (possibly in pairs) pieces of information or ideas or pictures or statements as a set of separate items, usually on cards. The subject could be: possible causes of global warming; the sayings of Christ; discoveries of the last 20 years; the music of Gershwin; causes of WW1; poems of Sylvia Plath; healthy lifestyle indicators; famous people etc.

The criterion for ranking the cards is given or negotiated with students. It could be to rank the cards in order of importance, appeal, relevance, how controversial, any other appropriate criterion.

The task is to debate the relative merits, to place them in rank order according to the chosen criterion, and to be able to explain and justify the ranking based on evidence rather than opinion.

Emotional Climate to build a Reasoning learning character

Soundbites are not enough

- » Explore strong chains of argument
- » Awareness and avoidance of mere debating tricks

Knowing when reasoning is important, and when not

- » Distinguish between creative and editing modes when writing (for example)
- » Swap to and fro between reasoning and intuition / creativity

Reasoning 'both ways'

- » Forwards through sound argument
- » Backwards by looking at assumptions used to support a line of argument

Safety to reason speculatively

- » Opportunities to hypothesise and predict are frequent
- » Questions about 'what should happen' are evident

Teachers as character builders

Learning habits form part of our character and develop through use and practice (deliberate or otherwise!). But desirable habits will survive and flourish better if students are aware of them, realise their value, and strive to improve them.

Cultivating habits involves:

- Providing rich and varied **occasions** for **exercising** learning habits
- **Infusing** learning habits into lessons to enhance content understanding
- Recognising and **celebrating** the use and **growth** of learning habits
- **Enabling** students to identify how and when to use learning habits
- Expecting students to take ownership of and **responsibility** for their learning habits
- **Exploring** the development of learning habits with students.

Teachers are influential character builders and need to be mindful of how they help students form, replace, re-form and strengthen their learning habits.

Are your teaching habits helping students' learning habits? Are you building learning characters who will succeed in life?

Take it steady! Think about how and when you might:

Stop/avoid:

- Telling students what will happen – let them work it out for themselves
- Doing the reasoning for them
- Planning everything yourself!

Experiment with:

- Introducing or using thinking tools that support disciplined, methodical thought
- The TASC model (Thinking Actively in a Social Context) to support a methodical approach to problem solving
- Using Brain Teasers to encourage logical, methodical thinking
- Playing Devil's advocate

Start/do more of:

- Creating more opportunities for students to plan their own learning & define their own outcomes
- Encouraging students to justify what they say
- Requiring students to show their workings as a visual demonstration of their logical train of thought

Start slowly:

- Inviting students to speculate and to justify what might happen next
- Using activities that exercise higher-order thinking skills of analysing, synthesising, justifying, and evaluating
- Creating situations where students need to work out a conclusion from partial facts or clues.

Reasoning is fun

» Puzzles, games, paradoxes are part of everyday activity

Rigour matters

- » Precise and accurate language
- » Accurate steps in building arguments

Display reflects 'work in progress'

- » Display shows the logical processes that sit behind the completed work

Talk to nudge Reasoning

Teacher talk - as a learning coach

(To ensure students do the thinking for themselves.)

What assumptions are you making?

What makes you think it doesn't work?

Can you think it through in clear steps from start to finish?

How many reasons can we find for that?

Let's take it a step at a time... What might be the next step?

Can you spot the false step there?

What evidence can you find to support your case/argument?

Can this... work without that...?

What's the counter evidence?

How have you reached that conclusion?

Which thinking tool would help us solve this?

Student self-talk

(As the skill becomes a habit, and as the habit shapes part of the learning character, look out for students who say (or think) the following)

Can I detect a flaw here, what's missing?

How could I tell if this is true?

Is this because...?

What if...

What evidence is there?

Have I considered all factors?

Why does that argument feel wrong?

Have I tested the implications

Is that really so?

Is this convincing?

How can I prove this?

Strengthening the habit

Student self-review

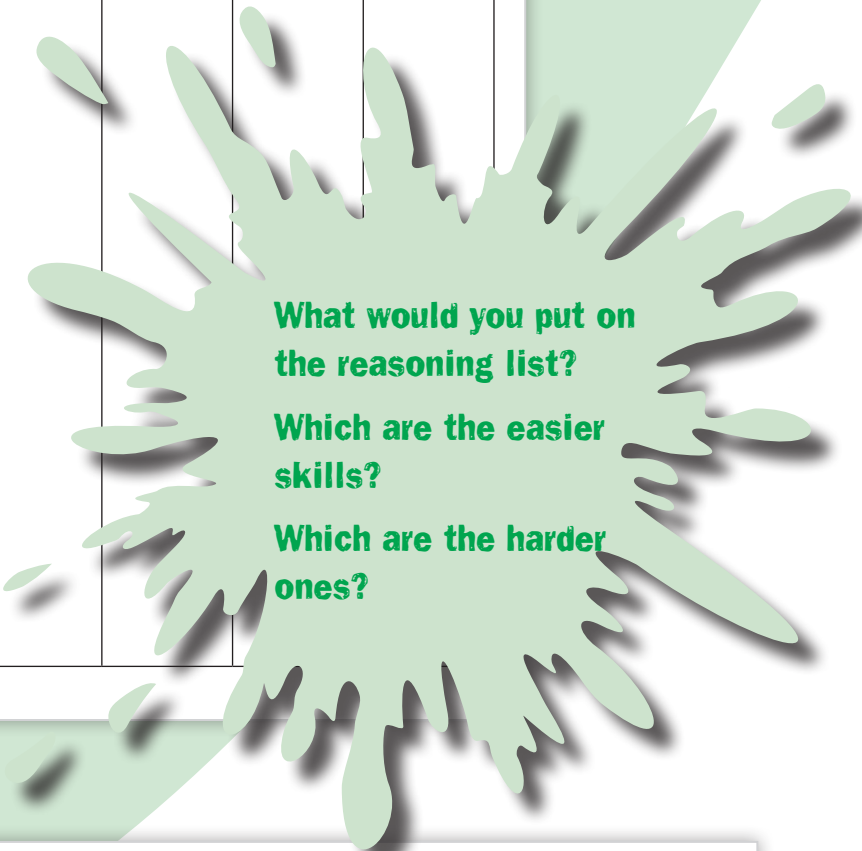
In order to strengthen learning habits, it is important for students and their teachers to reflect on the specific attributes that contribute to a well-formed habit.

Ipsative and formative approaches to reviewing learning habits place students at the centre of the process of developing their learning habits and strengthening their learning character.

Here is one way of keeping the reasoning habit alive and growing.

Ideas for self evaluation of reasoning

When I was solving the problem I:	A lot	Sometimes	A bit	Not yet
• Guessed what the solution might be • Jumped to conclusions • Thought about the problem before starting • Tried to work out what the problem was really about before starting • Compared and contrasted things against each other • Looked for patterns • Linked cause and effect • Presented my solution in clear steps • Created possible hypotheses based on evidence • Looked for evidence and counter evidence • Asked lots of questions about the evidence • Looked for red herrings and flaws in arguments • Used 'If this, then that' type arguments • Related the problem to others that I know or have worked on. • Worked out the arguments for and against a course of action • Tried to understand the parts in order to understand the big picture. • Tried to see the big picture in order to understand the parts • Made sure I hadn't missed something important.				



Reasoning

These At-A-Glance cards are based on the practical framework of learning capacities and habits known as Building Learning Power. The framework provides a clear picture of what it takes to be a good learner. The purpose of the approach is to grow students' Learning Character and Habits. In so doing Building Learning Power develops the appetite and ability to learn in different ways, and shifts the responsibility for learning to learn from teacher to student.

Find out more: www.buildinglearningpower.com

