CRITICAL THINKING FOR ACHIEVEMENT

Course handbook

Geographical Association

The Association for Science Education

Contents

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What do we mean by critical thinking, and how should we approach it?

Although critical thinking is widely considered to be a 'good thing' in education, there is no settled consensus on what it means, how it might be taught, or even how it benefits learners. Here are three different views about its key attributes.

1. The geographer **Margaret Roberts** (2013 p.125) suggests critical thinking centres on:

    - Rigour
    - Rationality
    - Reasoning.

It is 'a way of looking at the world and a disposition towards learning which is driven by seeking reasons and evidence'. Specifically, it also includes teaching students how to:

- Learn how to assess evidence
- Identify assertions not based on evidence
- Identify evidence based on fake authority
- Recognise faulty arguments
- Probe the assumptions behind what is claimed to be true
- Explore ambiguous concepts.

> Put simply, critical thinking involves recognising that 'things are not always what they seem to be', or 'there's more to this than meets the eye'.
>
> *Global Perspectives on the National Curriculum*.

2. The cognitive scientist **Daniel Willingham** (2007) defines critical thinking as being:
    - Effective, including:
        - seeing both sides of an issue
        - being open to evidence that challenges your ideas
        - reasoning from logic, rather than passion
        - ensuring claims are backed by evidence
        - drawing conclusions from available facts.
    - Novel, e.g. not simply rehearsing a prior solution to a problem
    - Self-directed, e.g. involving the student's thinking, not the teacher's.

3. A century ago the educational theorist **John Dewey** (1909) suggested 'An active, persistent and careful consideration of a belief or supposed form of knowledge:

    - An active process (rather than passive)
    - Persistent and careful (rather than jumping to conclusions)
    - Reasoned (rather than emotional).

A key discussion is the approach to critical thinking in the curriculum. A number of programmes teach critical thinking as a generic skill. The GA's programme is not one of them. It is based on the principle that critical thinking is best taught in a subject or disciplinary context: 'The processes of thinking are intertwined with the content of thought,

that is, domain knowledge' (Willingham, 2007 p.8). Bailin et al (1999) regard critical thinking as an important part of geography, science, history etc.: to be a good geographer necessarily involves thinking critically about the world, so it is best taught by 'infusing' in the curriculum rather than as a separate skill. Some go further, arguing that, because critical thinking is intrinsic to history (for example), there is little point in considering or teaching students how to think critically in these subjects: in learning history, they will necessarily be thinking critically.

> Effective critical thinking is neither an isolated skill, nor a generalised opportunity for thought. Rather it combines capability, the tools to think deeper, and the curriculum context to do so.

This discussion has significant implications for the approach taken by the GA and ASE:

- Critical thinking is neither an end in its own right, nor a discrete skill which can be deployed in any context. Rather it is a means to an end: that is better disciplinary thinking, towards (for example) greater geographical and scientific understanding, and therefore progress and attainment.
- However, we cannot expect students to think critically without the opportunity and the means to do so. This is particularly likely to be so for students with fewer opportunities for thinking this way outside school. Thus students need:
    - opportunities in the curriculum, for example, through enquiry and the study of disputed ideas, for example controversial issues;
    - background knowledge and understanding; students can't be expected to think deeply or critically about topics they know little about;
    - in contrast to the 'intrinsic' approach above, students need teaching which explicitly teaching which introduces and models different approaches to (for example) questioning, evidence and arguments; and develops students' capabilities through practice in geography, science etc.

  For example, students may simply equate arguing with having a dispute. To make progress they need the opportunity to investigate material where there is evidence supporting different approaches or points of view; knowledge of strategies to make and articulate an academic argument; and the means to do so, for example through discussion, debate or written responses.
- Students need practice in critical thinking, so viewing it as part of subject or disciplinary learning, rather than a one-off set of skills, is likely to be beneficial. Practising critical thinking systematically as part of geography or science learning makes it more likely that students will pick up contextual cues from the content about what strategies to use. This supports them in applying their thinking capabilities to new geographical and scientific contexts, for example forming an argument about a different geographical or scientific problem.

In summary: critical thinking is best taught in the context of subject content and achievement, rather than through generic programmes; it:

- is in favour of disciplinary progress and attainment;
- needs to be taught and practiced explicitly
- is for all students, not just more successful learners or those with considerable social capital.

Curriculum planning examples

1. **Learning about globalisation and interdependence;** fair trade with and without critical thinking:
   - **without critical thinking**: lessons that focus on the merits of fair trade, leading pupils to the conclusion that buying fair trade goods is the right thing to do;
   - **with critical thinking**: lessons that investigate fair trade in the context of different kinds of trade, building understanding of the processes and links involved so that pupils can examine each on merit, consider different views and, if they wish, decide whether to buy fair trade goods or not. Pupils might go further, for example comparing how evidence is presented by proponents of fair trade and free trade, or considering the ethical issues involved in making such decisions.

Planning opportunities to think critically about the material opens up the possibilities for better understanding of challenging ideas such as interdependence, and so for enhanced achievement.

2. **Learning about solids, liquids and gasses**, and using a particle model to explain the changes of state between solid, liquid and gas:
   - **without critical thinking**: lessons use a particle model to explain phenomena like melting and evaporation. Pupils are taught the value of using a particle model to provide an explanation for the behaviour of different states of matter;
   - **with critical thinking**: links are made between using a particle model to explain melting and evaporation, and the use of a similar model to explain other properties of matter. Alternative models are compared, with their respective strengths and weaknesses compared.

Critical pedagogy

If critical thinking can be summed as better thinking, critical pedagogy is an application of critical thinking which is more actively engaged in the world (see Hunt, 2018), for example thinking about decisions: who has the power to influence and shape the world? It is 'an approach to education underpinned by commitment to equality and social justice … [and] concerned with probing beneath the surface, taking into account how political, economic and cultural contexts and systems of belief, influence, and knowledge impact on people' (Roberts, p.125); for example, one objective from the Global Learning Programme curriculum framework, that young people should 'better understand their role in a globally-interdependent world and to explore strategies by which they can make it more just and sustainable' (GLP-E).

In learning science, critical thinking is involved in many scientific processes including:

- Pupils begin to see the connections between different science topics and become aware of some of the big ideas underpinning scientific knowledge and understanding.
- They should be encouraged to relate scientific explanations to phenomena in the world around them and start to use modelling and abstract ideas to develop and evaluate explanations.
- Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data.
- They should evaluate their results and identify further questions arising from them.

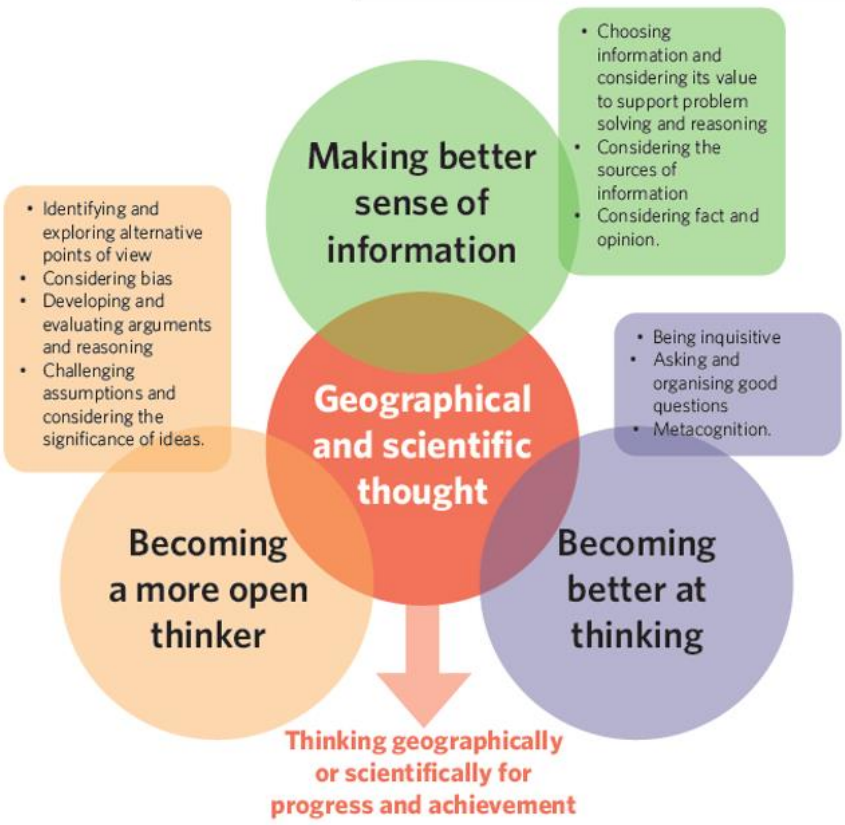
In the context of geography and global learning, Hetan Shah (2010) suggests the following characteristics of critical thinking:

- making connections within and between systems, such as between consumption and the environment
- awareness of how much is contested, such as important concepts like development and sustainability
- responding to complexity and change, for example by engaging with the world of today
- understanding the significance of power relationships, for example in addressing global challenges
- self-reflectiveness, for example remaining open-minded
- values literacy, for example through exploring our own values and those of others.

Critical thinking: a model for achievement

A key starting point for the approach taken in this programme is that effective critical thinking is neither an isolated skill, nor a generalised opportunity for thought. Rather it combines capability, the tools to think deeper and the curriculum context to do so – centred on geographical and scientific thought. It is a process, but a means of developing understanding and raising achievement in relation to the content of the curriculum. From that starting point, based on arguments put forward by Margaret Roberts (2013, 2015), we can begin to identify the different ingredients of critical thinking:

- **becoming better at thinking,** for example through developing pupils' ability to ask good questions and reflect on their learning. Here critical thinking helps strengthen curiosity and the first stages of investigations.
- **making better sense of information,** knowledge and ideas, such as by examining evidence, learning to distinguish fact from opinion and considering alternative solutions to problems. Here critical thinking helps build understanding and reach informed conclusions.
- **becoming a more open thinker**, such as by challenging assumptions through discussion and debate and considering ethical issues in a changing world. Here critical thinking helps pupils evaluate and become more autonomous learners, able to think through and reach their own well-founded arguments, based on evidence – which may also help make them more resilient to others' opinions.



The diagram shows these three ingredients together, with disciplinary thinking at the core. Although individual teachers may put more emphasis on one aspect or another, linking them together helps highlight that paying attention to all three aspects is helpful. Setting out the different aspects of critical thinking out like this may also help us get a fix on progression: the natural starting point for younger pupils is likely to be 'becoming better at thinking', especially through developing questioning, perhaps moving anticlockwise through 'making better sense of information' and 'becoming a more open thinker'. Moreover there is a strong link between critical thinking and the enquiry process in a range of disciplines.

Finally, a key characteristic of critical thinking is that it is *organised*. Being systematic, for example by introducing and developing strategies and ways of thinking over the longer term, helps teachers plan and pupils to become more capable and independent. Attention to all three aspects is helpful across the curriculum in supporting pupils' current learning, future employment and lives as knowledgeable and active citizens.

What do we mean by thinking geographically and scientifically?

To be a good geographer or scientist means thinking like one. Thinking geographically and scientifically is not everyday thinking. It means discovering and understanding the world through some big ideas and particular approaches founded in these disciplines:

Thinking geographically

> 'An essential educational outcome of learning geography is to be able to apply knowledge and conceptual understanding to new settings: that is to think geographically about the changing world.
>
> 'Thinking geographically is a uniquely powerful way of seeing the world. ... Thinking geographically does provide a language that can help us see the connections between places and scales that others frequently miss. That is why we should focus on geography's grammar [its ideas and concepts] as well as on its endless vocabulary [geographical information]. That is the power of thinking geographically: using big ideas to organise the information to understand the world' (GA, 2009, pp. 9-11, 30).
>
> Thinking geographically involves exploring 'a few large, organising concepts [that] underlie a geographical way of investigating and understanding the world … it is relational thinking that characterises the geographical perspective'; for example, between people and environments or between local and global scales (GA, 2012).

Thinking scientifically

Scientific attitudes

- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility

- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- evaluate risks.

Experimental skills and investigations

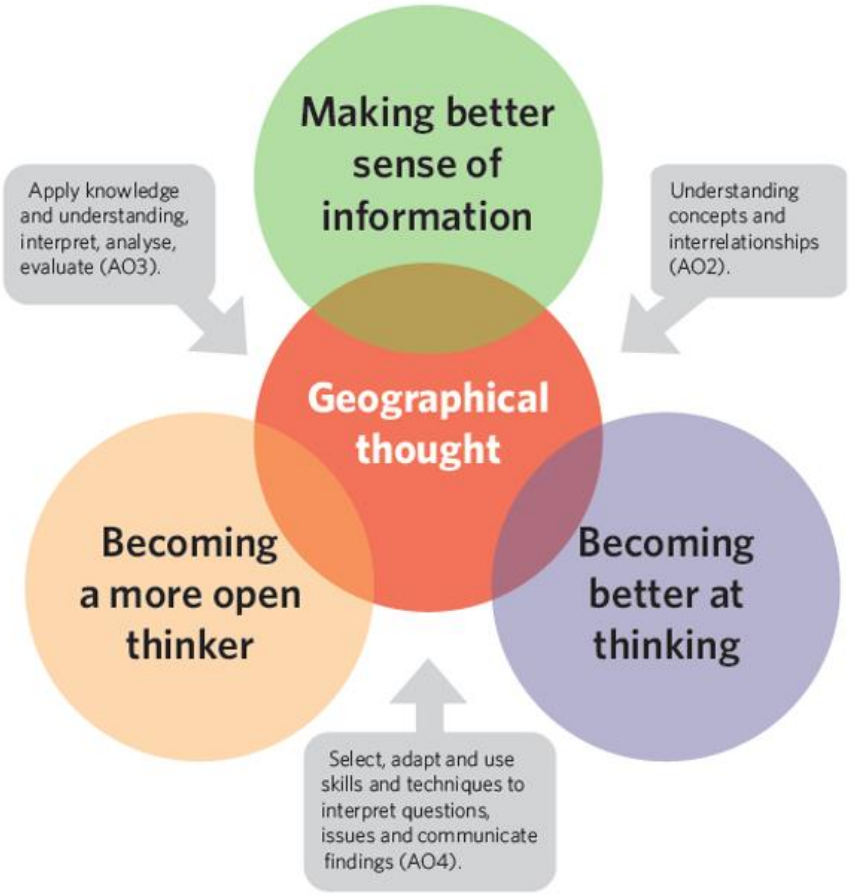
- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.

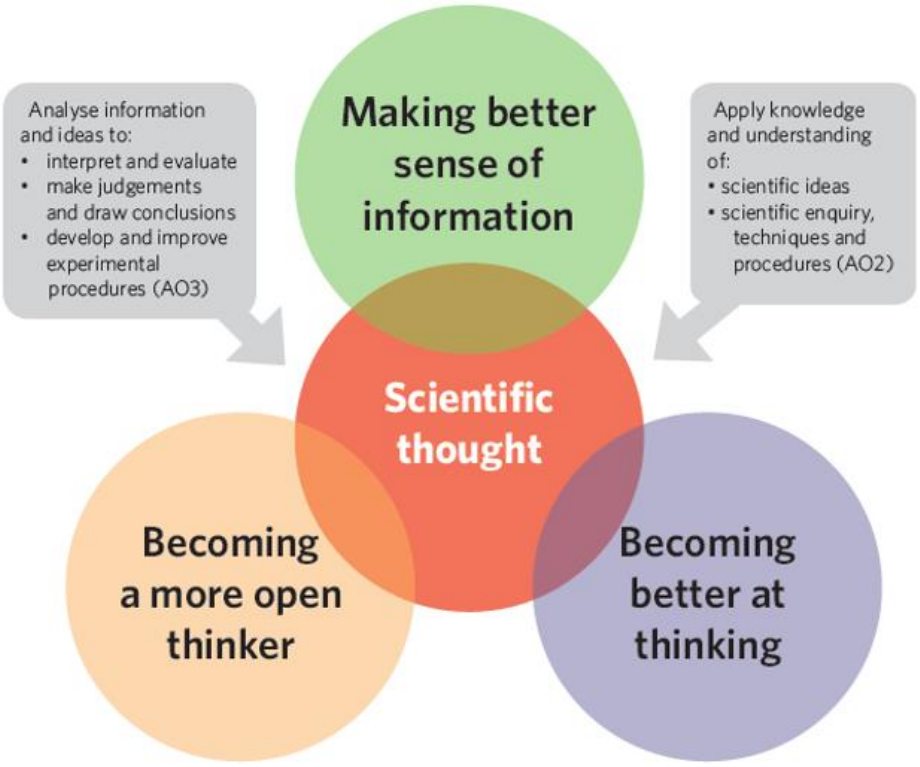
Analysis and evaluation

- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses
- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results.

Critical thinking and attainment in geography and science

Improving students' capabilities in thinking geographically or scientifically is a central purpose for the discipline, and critical thinking as a means of developing understanding has a direct focus on raising attainment: it is a process, and a product. The diagram below shows the links with different dimensions of achievement, as in the GCSE Assessment Objectives (AOs).





Critical thinking and attainment in geography

The aspects and dimensions of achievement[1]	Assessment Objectives: GCSE[2]	Assessment Objectives: A level
Contextual World Knowledge of locations, places and geographical features. • demonstrating greater fluency with world knowledge by drawing on increasing breadth and depth of content and contexts.	Demonstrate knowledge of locations, places, processes, environments and different scales (AO1)	Demonstrate knowledge and understanding of places, environments, concepts, processes, interactions and change, at a variety of scales (AO1).
Understanding conditions, processes and interactions that explain geographical features, distribution patterns, and changes over time and space. • extending from the familiar and concrete to the unfamiliar and abstract; • making greater sense of the world by organising and connecting information and ideas about people, places, processes and environments; • working with more complex information about the world, including the relevance of people's attitudes, values and beliefs.	Demonstrate geographical understanding of concepts and how they are used in relation to places, environments and processes, and the inter-relationships between places, environments and processes (AO2).	
	Apply knowledge and understanding to interpret, analyse and evaluate geographical information and issues and to make judgements (AO3).	Apply knowledge and understanding in different contexts to interpret, analyse, and evaluate geographical information and issues (AO2).
Enquiry and Skills: competence in geographical enquiry, and the application of skills in observing, collecting, analysing, evaluating and communicating geographical information. • increasing the range and accuracy of pupils' investigative skills, advancing their ability to select and apply these with increasing independence to geographical enquiry.	Select, adapt and use a variety of skills and techniques to investigate questions and issues and communicate findings. (AO4).	Use a variety of relevant quantitative, qualitative and fieldwork skills to: investigate geographical questions and issues; interpret, analyse and evaluate data and evidence; construct arguments and draw conclusions (AO3).

Critical thinking most relevant to achievement

[1] GA (2014) An assessment and progression framework for geography, https://www.geography.org.uk/Progression-and-Expectations-in-Geography
[2] https://www.gov.uk/government/publications/assessment-objectives-ancient-languages-geography-and-mfl/gcse-as-and-a-level-assessment-objectives#geography

Controversial issues

Controversial issues are a very useful means of developing and applying critical thinking in the curriculum. Controversial issues are:

- all around us in science and geography: they are important to help understand and engage with the contemporary world;
- often complex: critical thinking helps process and develop understanding, including non-routine, creative and divergent thinking;
- helpful in developing pupils' views and values, and understanding those of others.

Issues may be controversial for a variety, or combination, of reasons (Roberts, op. cit., pp. 114-127):

- because there is insufficient evidence to support an explanation or theory, e.g.: anthropogenic climate change in the 1980s (but not today);
- due to disputed claims about underlying facts, or differences of interpretation; e.g. what was the impact of the British Empire on development and interdependence? Is there a link between MMR vaccination and autism in children?
- there are different opinions about what should be done, due to uncertainty or conflicts of interests, values, or ideology; e.g.: should Heathrow be expanded? Should crop pests be controlled by genetic modification of the crop?
- for moral or ethical reasons, e.g. Should we fly abroad on holiday? Should we buy clothes made by child labour? Should human embryos be genetically screened as a matter of routine?

Margaret Roberts suggests that controversial issues should be investigated in school for a range of reasons, including:

- students can learn a range of skills through the study of controversial issues, especially those related to enquiry and critical thinking;
- studying controversial issues can equip students to guard against indoctrination, increasing their awareness of underpinning values and the need to examine these more critically: 'Schools can build pupils' resilience … by providing a safe environment for debating controversial issues and helping them to understand how they can influence and participate in decision-making' (Ofsted, Prevent Guidance).

In addition, in geography:

- the present geography of the world has been shaped by past decisions, including controversial ones; studying controversial issues today helps understand complexity and causation;
- geography is a political subject, including the study of many issues which are matters of legitimate dispute;

- values and ideologies are inherent in geographical knowledge, including the sources of geographical information and ways of seeing the world;
- students are interested in current issues that will affect their future, and arguably these are an important focus for the curriculum;

However, controversial issues can be tricky to get right, and teaching can be improved through professional development and debate.

Teachers' roles in teaching controversial issues

A common way of thinking of teachers' roles in relation to controversial issues is in relation to their stance:

- A balanced stance might mean attempting to give students information about alternative viewpoints.
- A neutral stance is often advocated, although it may not be suitable for some issues.
- A committed stance might include the teacher explaining their own views upfront, or advocating certain views or values, for example in support of the theory of evolution.

However, none of these is straightforward; for example there may be issues where the full range of views might be inappropriate, or the teacher's views are implicit but not declared. Most teachers would not find it permissible to promote or advocate particular viewpoints and stray into indoctrination. The Association for Citizenship Teachers suggests a more detailed set of approaches and tactics:

- As participant: the teacher joins in the discussion as a member of the class, which allows the teacher to be open about their own views whilst ensuring that they too can be challenged during the discussion process.
- Stated commitment: where the teacher makes known their view during the discussion.
- As impartial facilitator (or neutral chair): where the teacher never reveals their own positions.
- Taking a balanced approach (or stated neutrality): where the teacher presents pupils with a wide range of alternative viewpoints, even if this includes providing a personal judgment to balance other views expressed.
- As devil's advocate: the teacher consciously takes up an opposite position to the one expressed by pupils and advocating views they do not hold.
- As ally: the teacher takes the side of a pupil or group of pupils.
- Taking the official line: where the teacher promotes the side dictated by the public authorities (government, police etc.).
- As instructor: informing pupils of additional facts or testing the strength of their arguments as the discussion proceeds.
- As interviewer: asking pupils questions to elicit a range of responses.
- As observer: allowing pupils to debate with one another, with limited interventions.

Tactics for approaching controversial issues

Distancing: Introducing analogies and parallels can help to de-emphasise personal responses, e.g. using geographical, or scientific case studies; particularly useful when an issue is highly sensitive within the class, school or community.

Compensatory: introducing new information, ideas or arguments is necessary when pupils are expressing strongly-held views based on ignorance, the minority is being bullied by the majority or there is an unquestioning consensus.

Empathetic: introducing activities to help pupils see an issue from someone else's perspective is particularly useful when it involves groups which are unpopular with some or all of the pupils, the issue includes prejudice or discrimination against a particular group, or the issue is remote from pupils' lives.

Exploratory: introducing enquiry-based or problem-solving activities is useful when an issue is not well-defined or is particularly complex.

De-personalising: introducing society-orientated rather than person-orientated language when presenting an issue (e.g. substituting 'us', 'our', 'someone', or 'society' for 'you' or 'your' when addressing pupils) can be useful when some or all pupils have a personal connection with an issue and feel particularly sensitive about it.

Engaging: introducing personally relevant, or otherwise highly engaging material or activities is useful when pupils are apathetic and express no opinions or feelings about an issue.

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Links to further guidance on teaching controversial issues[3]

Guidance from the Geographical Association on teaching controversial issues:

- GTIP Think Piece - Values and controversial issues by Nick Hopwood
- GTIP Think Piece - Global Warming: teaching global warming as a controversial issue, by Alun Morgan

The Prevent Duty and Teaching Controversial Issues: creating a curriculum response through Citizenship, published by the Association for Citizenship Teaching, 2015: http://www.teachingcitizenship.org.uk/resource/prevent-duty-and-controversial-issues-creating-curriculum-response-through-citizenship

Teaching controversial issues; guidance from Oxfam: http://www.oxfam.org.uk/education/teacher-support/tools-and-guides/controversial-issues

Facing History and Ourselves: www.facinghistory.org/resource-library/teaching-strategies

[3] Source: Global Learning Programme, England

Research and evidence underpinning Critical Thinking for achievement

The *Critical thinking for achievement* project provides free CPD for primary and secondary teachers of geography and science, to strengthen teachers' subject knowledge and build confidence and capability in curriculum planning and teaching.

1. **Better use of evidence and enhanced criticality equip pupils with the knowledge and skills they need:**

- The EEF Metacognition toolkit cites extensive RCT, systematic review and meta-analysis evidence for the impact of metacognitive routines, including independent thinking, criticality and use of evidence. EEF suggests these 'high impact, for very low cost' approaches are applicable to science education and more widely.
- Willingham's meta-analysis of the outcomes of critical thinking research programmes (Willingham 2007) found successful programmes embed critical metacognitive strategies into subject curricula and allow time for teacher practice, making critical thinking more likely by placing methodologies within appropriate contexts.
- Bailin e al (1999) concluded that, not only is critical thinking developed in relation to specific knowledge domains, but that the educational value of routines for such thinking depend on a good understanding of the task, so that the task is 'done in such a way as to fulfil relevant standards of adequacy'.
- The GA Connecting Classrooms (2015-18) programme found critical thinking through a subject lens significantly increased teacher knowledge and understanding and demonstrated positive impact on teacher confidence and expertise, pupil engagement, attainment and progress.
- A range of academics (Cambridge Assessment 2010) argue critical thinking delivered through robust pedagogy and applied in subjects has a positive impact on attainment.
- In *Education for All* (2014) UNESCO identified a 'need to ensure that young people learn foundation skills in a manner that enhances transferable skills such as critical thinking, problem solving … in order to help them become responsible global citizens' (p.49).
- A 2017 research literature review found pupils do not have the critical skills they need to identify fake news.
- A survey of 633 academics (OCR 2012) showed independent inquiry, research and critical thinking skills within subjects are undergraduate weaknesses but are essential to the transition to HE.

2. **Subject-specific CPD raises teaching quality most effectively:**

- A systematic review of international evidence (Teacher Development Trust 2015) found professional development focussed on generic pedagogy to be insufficient; effective CPD requires subject knowledge & pedagogy and helps teachers understand how pupils learn in specific subjects (p.20).

- A review of systematic reviews (Wellcome Trust 2018) showed effective CPD 'focussed directly on developing knowledge or practice in a subject area, or focussed on developing an aspect of teaching and learning in ways which are contextualised for specific subjects' (p.5); that subject/pedagogic approaches need to be supported by classrooms materials and that effective CPD supports teachers with application (p.25).
- A School Workforce Census (SWC) analysis (Social Market Foundation and Education Datalab 2016) demonstrated that teachers in schools serving disadvantaged communities lack experience or specialist subject qualifications. Building teacher confidence and capability through subject-specific intervention is particularly important in these schools.
- *Improving Science Teacher Retention* (Wellcome Trust 2017) used the SWC to find an association between subject-specific CPD and teacher retention (p.8).

3. Sustained, collaborative enquiry through teacher networks is impactful, particularly when supported by external expertise:

- The DfE (2016) *Standard for teachers' professional development* makes clear that impactful CPD focuses on subjects and pupil outcomes. It uses evidence, professional collaboration, external intervention and sufficient time to effect changes in practice.
- A systematic review of evidence (Cordingley et al 2003) found sustained, collaborative CPD was 'linked with a positive impact upon teachers' repertoire of teaching and learning strategies, their ability to match these to their students' needs, their self-esteem and confidence, and their commitment to continuing learning and development. There is also evidence that such CPD was linked with a positive impact upon student learning processes, motivation and outcomes' (p.8).
- Coburn's review of theoretical and empirical literature (Coburn 2003) found face-to-face teacher networks generate a shared sense of purpose, creating autonomy and a 'safety in numbers' effect in which members give one another permission to do things differently, encouraging experimentation leading to 'deep and consequential change in classroom practice' (p. 4).
- A rapid evidence review (Wellcome Trust 2018) identified a need to enhance subject-specific work across networks to ensure this meets the needs of schools in disadvantaged areas (p.7); it found structured peer-to-peer support strengthens CPD impact (p.6).
- The ASE **Getting Practical** project trained 200 teachers to lead CPD to colleagues and reached 2000 teachers. The independent academic evaluation found the teacher-practitioner CPD approach brought substantial change in the use and effectiveness of the investigatory pedagogies promoted.
- The GA's critical thinking CPD found peer networks helped secure teacher commitment to change practice 'in the presence of others', a benefit supported by behavioural psychology (Gollwitzer and Sheeran 2006).
- *Developing Great Subject Teaching* (Wellcome Trust 2018) found that the involvement of external subject specialist strengthens CPD impact (p.6).

- *Developing Great Teaching* (TDT 2015) found external facilitation a common factor in successful outcomes if it provides diverse perspectives and challenges orthodoxies within schools, especially where the expert works as a facilitator alongside local experts (p.24).