Critical Thinking
What it is. How it works. Why it matters
Executive summary
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Critical thinking skills are tools that help us to draw effective conclusions and take the right decisions. Using them effectively minimizes the prospect of error and maximizes the chances of success.

The ability to think critically is what makes us adaptable and capable of tackling new challenges. These are real-life skills with many practical applications.

Critical thinking skills are not innate or fixed. They can be taught and they can be improved.

Critical thinking works by providing a toolkit of skills – such as analysis, evaluation, and interpretation – that collectively allow us to tackle unfamiliar situations and new ideas.

They are increasingly necessary skills to have in a world that is changing rapidly, and in societies in which there are no longer jobs for life.

Different academic disciplines, and different jobs, demand different combinations of thinking skills. But all these skills are best taught explicitly – and, when taught, they should be integrated into the teaching of other subjects, not positioned as a subject of their own.

Those who lack effective critical thinking skills tend to be less flexible, less self-aware, and less successful than those who have learned to think effectively and well.
Thinking skills are the life skills that education teaches you. They are the tools we use to explore new ideas, evaluate possible courses of action, and create new and viable solutions.

You cannot study effectively, at school or university, if you cannot think critically – if you lack the ability to analyse, to evaluate evidence, to solve problems, interpret, and reason. And you cannot succeed in a career, or as an individual, if you cannot sift through information, distinguishing between what's useful and what's useless, and between good ideas and bad ones.

So “critical thinking” is nothing to do with negativity or nit picking. It’s about asking questions – the right questions. It’s about not accepting things on trust. It’s about empathy, not least having the self-awareness to accept that you may get things wrong. And it’s about finding new and creative solutions where others see only problems and a mass of data. Having the right skills to think critically doesn’t mean that you’ll always be right, but it does maximise your chances of success, and it does mean that you are less likely to make expensive or damaging mistakes.

What is critical thinking?

Critical thinking involves reshaping knowledge, not simply the recall of facts.
We can sum up critical thinking, then, as a product of “metacognition” – that is, thinking about thinking. It is the sort of thinking that takes conscious effort and involves reshaping knowledge, not simply the recall of facts. For psychologists and educators, this means that critical thinking is defined as a “higher-order” skill – something that is more advanced than the “lower-order” skills of remembering, understanding, and applying knowledge. We can say that it is the sort of thinking that demands initiative.

The ability to think critically is thus the ability to think rationally and well. It correlates closely not only with the propensity to reflect, and to consider alternatives, but also with the readiness to admit we may be wrong.

Ultimately, critical thinking is important because it is what makes us adaptable, enables us to act independently, and allows us to move beyond what we already know or guess.

In short, thinking skills are the tools we use to arrive at new understandings.

And critical thinking is the process through which we progress.
Critical thinking skills work by improving students’ ability to analyse, evaluate, and create arguments. They require that evidence and assumptions be examined with rigour and caution. By mastering thinking skills, students are provided with tools that allow reasoned analysis and evaluation of ideas, and ensure that they are interpreted in a fair and balanced way.

A significant factor in successful thinking is the consistent application of what may be termed “attitudes of mind.” Dr. Roy van den Brink-Budgen, who has worked in the field of thinking skills for three decades, and who authored the British national exam syllabus for critical thinking, suggests that successful thinkers consistently display a well-defined and linked set of traits. Such students are:

- Persistent in thinking
- Flexible in thinking
- Able to control impulsivity
- Trained to search for accuracy
- Able to communicate with clarity and precision
- Willing to take measured risks in thinking
- Careful to apply existing knowledge to new situations
- Open to new possibilities and further learning

Critical thinking involves reshaping knowledge, not simply the recall of facts.
Van den Brink-Budgen's summary of the characteristics of a successful thinker imply that critical thinking inculcates a set of virtues familiar to any teacher or advanced student:

Persistence • Rigour • Openness • Diligence

This definition, however, incorporates one very important assumption, which is that critical thinking and the skills associated with it are taught explicitly rather than being absorbed indirectly by students via ordinary teaching. There are two reasons why the active teaching of thinking skills is more effective than assuming they can be taught implicitly. One is that, to work well, these skills need to be used consistently and applied persistently. This implies that they ought to be at the forefront of a student's mind, and deployed consciously, rather than being merely part of a student's unconscious working practices; if they are not, then many less able or less conscientious students will neither acquire nor use them. The second is that, by imparting thinking skills distinctly and systematically, teaching defines and codifies them in ways that make them transferrable. This is an important extra step, not least because study at school and university is sufficiently different from thinking in real life or in a working environment that it cannot be assumed that those who acquire thinking skills implicitly rather than explicitly will recognise their value outside the classroom, or consciously recall them and apply them (Fisher, 2001).

To work well, these skills need to be used consistently and applied persistently.
These insights can, in turn, be linked to those of Robert Ennis, emeritus professor of education at the University of Illinois, who has studied critical thinking for more than half a century (Ennis, 1962). He provides a detailed breakdown of the processes that underpin successful critical thinking, and these processes are clearly teachable (Ennis, 1993).

- Judge the credibility of sources
- Identify conclusions, reasons and assumptions
- Judge the quality of an argument – especially its reasons, assumptions, and underlying evidence
- Develop and defend a position on the issue
- Ask the appropriate clarifying questions
- Plan hypotheses or experiments, and assess experimental designs
- Define terms in a way appropriate to the context
- Be open-minded
- Be well-informed
- Draw warranted conclusions, but with caution

Experts on critical thinking differ considerably on the most effective context in which the skills associated with critical thinking should be taught, but the recent proposal of McLaughlin & Moore (2012), that it be integrated at college level through the use of rubrics – sets of written criteria accompanied by scoring tools – appears to be gaining momentum. For example, the AACU – the US university association most closely with elite educational institutions, with a membership that embraces Harvard, Princeton, and Yale – has issued an approved critical thinking rubric (AACU, n.d.). Stevens & Levi (2005) report that the use of rubrics in and of themselves can promote the development of critical thinking among students.
How we be sure that critical thinking skills are real?

Hundreds of academic studies have been conducted to show that critical thinking exists, to analyse its constituent parts, and to establish both how it can be measured and how it can be developed.

The key studies that have shaped, clarified, and defined our understanding of critical thinking include the following:

- The US National Research Council has defined critical thinking as a “twenty-first century skill” and concluded these skills “reflect important dimensions of human competence” (Pellegrino & Hilton, 2012).
- A meta-analysis of 117 studies of critical thinking and its impacts found 161 verifiable effects of critical thinking interventions, and concluded that these effects “cannot be a matter of implicit expectation” (Abrami et al., 2008).
- A positioning paper by the Association of American Colleges and Universities – which represents the elite research institutions of the United States, including Harvard, Yale, Columbia, Princeton, and Berkeley – lays stress on the importance of critical thinking as a “habit of mind,” and defines it as “characterized by the comprehensive exploration of issues, ideas, artifacts, and events, before accepting and formulating an opinion or conclusion” (AACU, n.d.).
There is general agreement that critical thinking is made up of a number of distinct sub-skills. A qualitative survey based on interviews with 46 academics, and sponsored by the American Philosophical Association, concluded that, collectively, these skills generated the ability to draw valid inferences and analyse arguments (Facione, 1990). A survey of 120 academics currently working in the humanities, arts, and social sciences in the US and UK, conducted by the University of Cambridge on behalf of Macat, produced clear guidance as to what these sub-skills are.

A clear link exists between the quality of an individual's argument and the same person's disposition to think actively and open-mindedly (Stanovich & West, 1997).

A meta-analysis of 100 earlier studies established that “need for cognition” – meaning the tendency to engage in, and enjoy, active critical thinking activities – not only varies from person to person, but is a product of intrinsic motivation, behavioural histories, and past experience. This suggests that the tendency to think critically is not an innate ability, but a skill that can be developed and taught (Cacioppo et al., 1996).

Surveys of university-level academics and of postgraduate students moving on to business school establish that critical thinking is best taught not as a distinct subject, within a broader curriculum, but by being integrated into the teaching of existing disciplines (Facione, 1990; Whitten & Brahmasrene, 2011).

Critical thinking is made up of a number of distinct sub-skills.
• Potentially the most effective way of teaching critical thinking skills integrated with existing disciplines in this way is to examine them systematically on an interdisciplinary online platform (Bednarikova, 2015).
• Thinking processes can be diagrammed and assessed in such environments, and reasoning practices incrementally enhanced, via the use of critical questions in specially designed argumentation frameworks (Nussbaum & Edwards, 2011).
• The effect of online teaching can be further enhanced by the addition of gamification, according to a meta-analysis of empirical studies of gamification (Hamari et al., 2014).

“Critical thinking is a “habit of the mind””
Educators and teachers have been moving towards a commonly accepted definition of critical thinking since at least 1909, when the American philosopher John Dewey defined “reflective thinking” as “active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends” (Dewey, 1909). Ennis later advanced a very comparable definition that laid special stress on thinking as “reasonable” and “reflective” (Ennis, 1989).

Most of those who have followed Dewey and Ennis have further concluded that critical thinking is a collective term for a linked range of skills, though the contents of this “basket” have been variously defined. Probably the most commonly cited modern breakdown of critical thinking skills is that advanced by Facione in his “Delphi Project,” commissioned by the American Philosophical Association. This defined six “core critical thinking skills”: inference, explanation, evaluation, self-regulation, interpretation, and analysis (Facione, 1990). Other studies differ significantly, however. For example, Fisher and Scriven consider explanation as a separate thinking skill (Fisher & Scriven, 1997), while van den Brink-Budgen stresses the central importance of argumentation skills (van den Brink-Budgen, 2010). Few other scholars have followed Facione in defining “self-regulation” as a thinking skill; rather, such a checking process is generally assumed to be incorporated in the other skills.
It is clear from this discussion that critical thinking can usefully be viewed as a subset of “thinking skills” in general. Ashman and Conway, in their widely accepted definition, suggest that the broad set of “thinking skills” encompass metacognition, critical and creative thinking, problem-solving, and decision-making, together with representation and summarising (Ashman & Conway, 1989). Some authorities add spatial reasoning to that list, however, and in some circumstances – notably in teaching the humanities, arts, and social sciences (the HASS disciplines) – problem-solving, which is usually considered a numeric skill, can be defined as a verbal critical thinking skill. Decision-making is sometimes added to this list, and when it is it is most often considered as an “applied critical thinking skill” (Fisher, 2001).

A further distinction can be made between the types of skills acquired and deployed by students in different disciplines. Most obviously, there is a clear distinction between the skills of logic, deduction, and inference, which are particularly important in philosophy and in science, technology, engineering, and maths (the STEM disciplines), and are the skills measured by the influential Watson-Glaser critical thinking appraisal (Watson & Glaser, 1964), and those of analysis, evaluation, and interpretation, which are more commonly required in the HASS disciplines – those where argumentation and the evaluation of evidence are central to progress and there are few “right” and “wrong” answers.
In order to arrive at a clearer and more definitive understanding of the elements of critical thinking, Macat has worked with the University of Cambridge to conduct a detailed survey of academics working in the HASS disciplines. This survey, carried out in 2015 among a sample almost three times the size of that surveyed by Facione for the Delphi Project study, showed that critical thinking, in the HASS environment, can be broken down into six distinct but linked skills: the PACIER skill-set.

P...roblem-solving
Developing a strategy; organizing a strong argument; being persuasive – all these are problem-solving skills. But finding solutions is not always straightforward. Problem-solving also teaches you how to identify the information you need from a mass of data – and how to combine apparently unrelated information into workable solutions.

A...nalys...is
Analytical skills lie at the heart of the best thinking. They speed up your ability to assess arguments by breaking them down into bite-sized chunks. Analysis also helps you to establish how well the pieces of an argument fit together.

C...reative thinking
The ability to think creatively is the toughest thinking skill to master, but it’s also the most powerful. It means taking key problems, assessing hazards and potential answers – and then creating coherent new solutions of your own.
I...nterpretation
Interpretation involves decoding the meaning and significance of evidence and experiences. It means asking “What does this evidence really tell me” – just as a detective or a scholar might.

E...valuation
Evaluation is the skill of assessing the strengths and weaknesses of an argument. Improving your ability to evaluate makes it much easier to decide whether someone else's argument is weak or strong. It also helps you to deal with attempts by other people to knock down your own arguments.

R...easoning
Reasoning takes two forms. Inductive reasoning is about safely extrapolating broad generalisations from specific observations. Deductive reasoning is the dissection of hypotheses to reach logical conclusions. It's the forensic skill used by attorneys, and it demands the identification of gaps in evidence, or flaws in logic.

Both the size of the Cambridge study, and the clear parallels it establishes with the levels of “higher-order thinking” defined by Bloom's taxonomy, suggest that this breakdown of the critical thinking skills demanded in the humanities, arts, and social sciences can be regarded as definitive.

(Bloom's taxonomy is the pre-eminent classification of learning outcomes that lies at the heart of much modern educational theory and practice. As recently revised (Anderson et al., 2000) Bloom's establishes six domains of learning, three of which are considered “higher-order.” The higher-order domains, in descending order of difficulty, are “creating”, “evaluating,” and “analyzing”.)
Early studies of critical thinking (e.g. Glaser, 1984) frequently concluded that critical thinking was an innate ability, and not a skill that could be actively taught.

Since Glaser published, however, the consensus has changed. Critical thinking skills are now almost universally regarded as teachable, and an extensive theoretical and experimental literature discusses how this can successfully be done. Much of this work has been summarized by Sherlynn Bessick.

The strategies suggested for improving critical thinking skills focus on metacognition, drawing on life and study experiences, and the provision of models of what constitutes “best practice.” Bessick summarises the current consensus as follows: “A first step in the assessment of critical thinking, a comprehensive definition of critical thinking, and the use of various measures of critical thinking” (Bessick, 2008).
No comprehensive tests exist which claims or has been proven to examine all the elements of critical thinking, and it is clear that the only adequate way of proceeding is, first, to clearly benchmark each student’s propensity to think critically and their actual abilities, in each of the categories of critical thinking, before instruction starts and after when it finishes; this is necessary to resolve doubts as to what element in any improvement may be attributed to instruction, rather than to other influences within a subject group. This work needs to be done scientifically, with the addition of control groups, and it needs to involve separate but comparable tests and entry and exit (Ennis, 1993).

A second criterion is the use of write-in answers, rather than multiple choice tests, since numerous studies show that critical thinking cannot be adequately assessed by using multiple choice tests alone (Bessick, 2008).

Work done using these criteria has demonstrated that critical thinking skills can be improved in two different groups, nurses and pharmacy students (Soukup, 1999; Phillips, Chesnut, & Rospond, 2004).

Macat is currently engaged in studies conducted with the University of Cambridge which examine if and how critical thinking skills can be taught and improved in the field of HASS. Results of these studies are due in the first half of 2016.
Critical thinking is important for two significant reasons.

First, it helps to maximise the efficiency of the work and thinking that we do, and to minimise the likelihood of error.

Second – and this is the chief reason it is considered a “twenty-first century skill” – it provides those who have mastered its elements with a skill-set that makes it possible to move successfully from job to job, and from career to career. Critical thinking, in this view, supplies the flexibility that the modern world demands of us. This is of increasing importance at a time in which few can now expect to spend the whole of their working lives in one industry, building and developing a single set of working skills.

If these two conclusions are accepted, then a third follows: it is of vital importance that critical thinking be elevated from its current position as a skill that is either assumed to be taught innately, or which, if taught explicitly, is introduced only occasionally, and not often taught well.

Michael Scriven has argued that critical thinking should, rather, be viewed as a fundamental skill – “an academic competency akin to reading and writing” (Fisher & Scriven, 1997). The evidence considered in this paper implies that he is right. If so, then the way in which critical thinking is conceived of, and taught, requires radical revision. And that revision needs to be made quickly if the problems that the new century throws up are to be successfully negotiated.
Bibliography


