CRITICAL THINKING:

Definition and Structure

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1 CRITICAL THINKING FOR THE 21ST CENTURY

The development of critical thinking as an essential skill in 21st-century learning is uncontested within educational and professional settings. The degree to which it is operationally defined, taught and assessed, however, is not well documented. This complicates efforts to develop critical thinking in students, as well as devise intervention techniques and assessment tools.

The ACER critical thinking framework has been developed to address the challenges associated with teaching and assessing critical thinking. While there are many definitions of the skill, few provide a means to operationalise critical thinking in the classroom. The framework outlines critical thinking processes along prescribed *strands* and *aspects* informed by a sound evidentiary basis. The *aspects* contained within the framework are designed to provide foci for teaching and the basis of assessment.

Aligned with the nature of the classroom, the proposed framework characterises critical thinking as cognitive processes that are ultimately goal directed and purpose driven. Whether that purpose is to solve a problem, support a theory or statement, conduct an experiment, formulate an argument, present an interpretation, undertake a critique, better understand a topic or decide on a course of action, the skills here presented assume that critical thinking is not simply reflective thought; it is also applied and generative.

As a teaching and assessment resource, the ACER critical thinking framework describes critical thinking both as generally applicable sets of skills, and as they tend to be operationalised in practice. The skill can be described and understood in a generalisable way that can be applied across disciplines with this framework providing a consistent terminology with which to do so. The aspects can be used to write or map assessment items, or the aspects can be integrated into lesson plans. The aspects of critical thinking need to be embedded within the methodologies, conventions and 'ways of knowing' of each of the disciplines to give their application context, to ensure they are relevant, and that they can be sustainably integrated.

The full framework paper, which outlines the literature behind the framework can be accessed at https://research.acer.edu.au/ar_misc/41

2 THE ACER CRITICAL THINKING FRAMEWORK

The ACER critical thinking framework describes critical thinking within strands (core elements) that are then further qualified as aspects (sub-elements). Specifically, a *strand* refers to the overarching conceptual category for framing the skills and knowledge addressed by critical thinking assessments, while an *aspect* refers to the specific content category within a strand. Specifically, the ACER framework comprises three strands, with each strand containing three aspects (summarised in Figure 1 and described in detail). The aspects encompass the set of knowledge, skills, and understanding held in common by a range of definitions in the literature.

Accordingly, the formal definition provided holds that:

To think critically is to analyse and evaluate information, reasoning and situations, according to appropriate standards, for the purpose of constructing sound and insightful new knowledge, understandings, hypotheses and beliefs. Critical thinking encompasses the subject's ability to process and synthesise information in such a way that it enables them to apply it judiciously to tasks for informed decision-making and effective problem-solving.

An assumption that underpins the ACER framework is that while it may be theoretically possible in definitions of critical thinking to distinguish underlying abstract skills (e.g. Facione, 2015), these skills in practice become operationalised simultaneously, or in a near-simultaneous manner, when authentic critical thinking tasks are performed. Though there is much agreement in the literature that critical thinking comprises at least the abilities of inference and evaluation, as well as analysis, interpretation, explanation and self-regulation (Thomas & Lok, 2015), it is often the case that, in our natural, everyday use of critical thinking, these (and other) skills are employed in parallel with each other rather than discretely or in isolation. For example, in practice, to evaluate an argument is the near-simultaneous result of reading or listening, interpreting, analysing and inferring from it, while also continually judging it against criteria, and monitoring and self-correcting one's own evaluation. Further to this, it is not necessarily the case that to 'analyse', to 'self-regulate' or to 'evaluate' are the same skill in all applied contexts; being able to evaluate a source of information for reliability is not the same as being able to evaluate the logic of an argument or one's options within a decision. Functionally, the same abstract skill manifests as different skills within different applications. Thus, for the purpose of assessment, the strands are each delineated based upon different applications of critical thinking: to construct knowledge, to evaluate reasoning and to make decisions. Within the aspects of each of these, it is assumed a combination of core critical thinking skills are being applied simultaneously to produce the desired outcome.
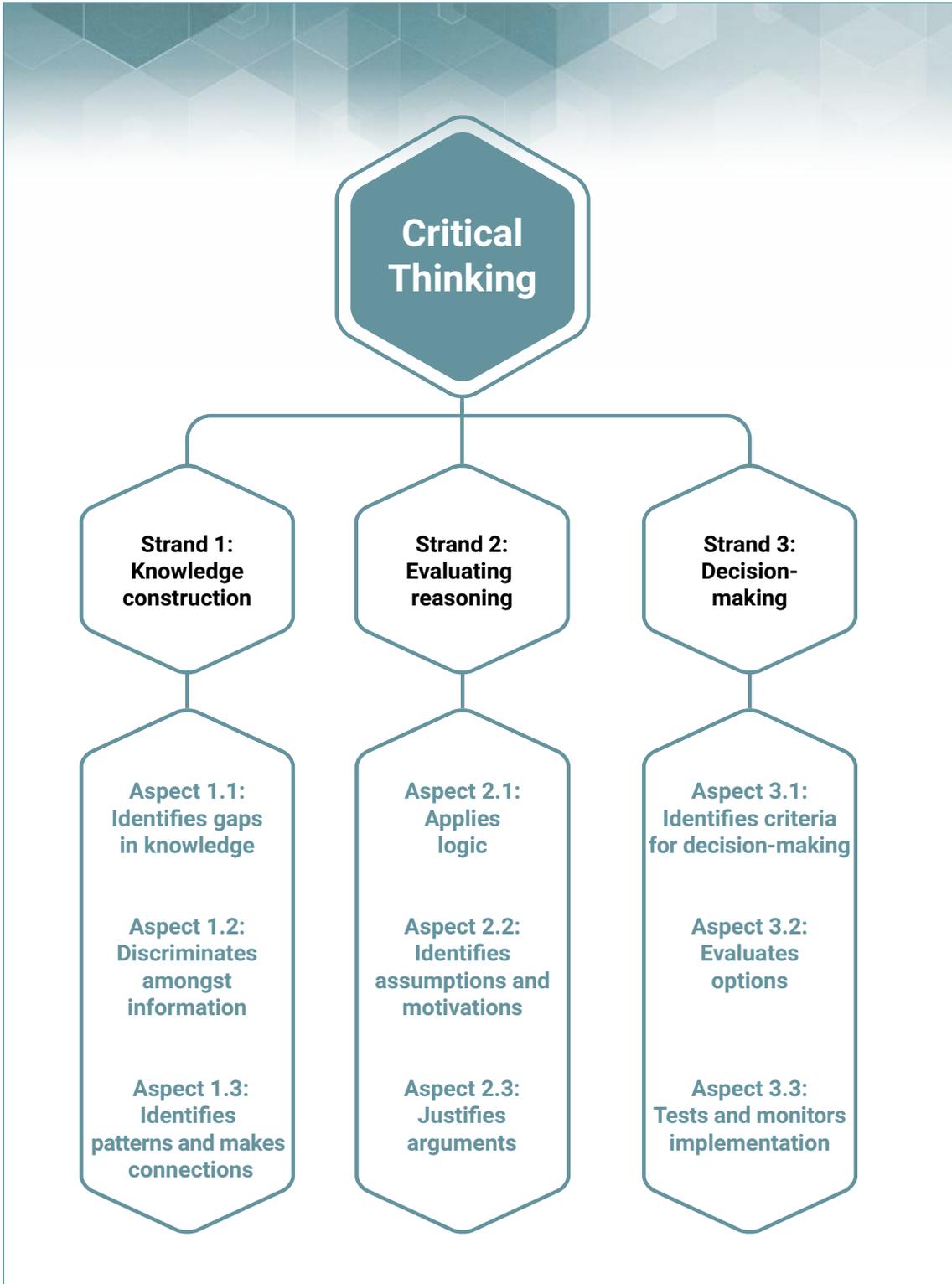
Figure 1 ACER's critical thinking framework

Strand 1   Knowledge construction

Knowledge construction relates to the kind of reflective and evaluative engagement with information that is required to make accurate sense of it. It involves establishing what we know and what we need to know, what information seems plausible, useful and reliable, and how it can best be organised to derive explanatory sense and meaning from it.

Aspect 1.1   Identifies gaps in knowledge

Identifying gaps in knowledge is about discerning what information or evidence one needs in order to know or believe something, to understand an issue, or to address a problem or task (Kuhn, 1999; American Libraries Association, 1989). It involves analysing and evaluating what one already knows, and recognising that one may not have all of the information required (Bent & Stubbings, 2011), or that one may be operating under certain misconceptions. Acknowledging possible deficiencies in one's own understanding may take the form of posing questions to prompt further investigation and enquiry (Ennis, 2018). It also involves a disposition towards considering, if not necessarily incorporating, information from different sources or differing perspectives to bridge gaps in understanding and gain a fuller picture of the situation or issue (Facione, 1990; Glaser, 1941).

Aspect 1.2   Discriminates amongst information

Once information has been sourced, collected and read, in order to think critically about its content, it needs to be evaluated via the application of criteria (Grafstein, 2017; Paul & Elder, 2007). Discriminating amongst information and evidence includes identifying and evaluating factors such as the currency, reliability, relevance, authorship, completeness or veracity of it. It may include distinguishing fact from opinion, determining the strength of evidence provided for a given claim and discerning information that is directly useful for one's purposes from that which is not (Brookfield, 1997; Fisher & Scriven, 1997; Sternberg, 1986).

Aspect 1.3   Identifies patterns and makes connections

This aspect refers to the act of reflecting on and organising information such as data, evidence, statements, questions, concepts, opinions, and other forms of representation, in order to create sense and meaning from it (Sternberg, 1986; Watson & Glaser, 1964). It requires the ability to analyse and sort information to find patterns and construct conceptual relationships within it (Fisher & Scriven, 1997). This often leads to the formulation via induction of tentative 'rules' or theories to best explain these patterns, on the basis of generalisations derived from them (Ennis, 2018). It also involves the recognition of exceptions and counter-examples, and the possible significance of these.

Strand 2   Evaluating reasoning

Evaluating reasoning refers to the thinking required to discern the validity of arguments, scientific theories, statements, proofs and other formulations of ideas. It involves analysing and evaluating verbally-constructed arguments, sets of propositions and other non-verbal representations of information and relationships to identify the premises that underpin a conclusion or truth claim, judging the logic of how conclusions are reached, and ensuring one's own arguments or formulations are sound. Reasoning itself can be represented in a variety of forms such as verbal,

spatial, abstract, numerical, mechanical, algorithmic and graphical. When working in complex problem-solving contexts, a variety of representations of reasoning may be present.

Aspect 2.1   Applies logic

Applying logic involves being able to reason through sets of propositions, rules, conditions, statements, and premises to arrive at a true or valid conclusion (Dewey, 1933; Ennis, 2018; Facione, 1990; Glaser, 1941). It requires the ability to apply concepts of propositional logic such as inference, causality, contradiction, and consistency. Applying logic can be done reflectively to evaluate the truth or validity of a given conclusion. It can also be applied predictively (i.e. beyond the parameters of a given argument or set of conditions) in order to make sound predictions as to what an argument or set of conditions mean – or whether they are still valid – in a different context (Ong et el., 2018). It entails the ability to identify fallacies and technical flaws in various representations of reasoning (Paul & Elder, 1999a; 1999b).

Aspect 2.2   Identifies assumptions and motivations

Beyond evaluating the technical aspects of an argument (or other representations of reasoning) as it is presented, critical thinking also requires the ability to identify and evaluate the un-presented elements that operate within one's own – or someone else's – reasoning. It involves identifying where certain conclusions are predicated on assumptions, what assumptions these are, and whether they are reasonable (Ennis, 2018; Glaser, 1941). Related to this, it entails the ability to think sceptically about opinions, explanations or propositions made, in order to identify possible biases that may be governing the line of reasoning presented, and the values or beliefs that may be motivating these (McPeck, 1981; Mezirow, 2009).

Aspect 2.3   Justifies arguments

Justifying arguments involves the ability to formulate one's ideas, and hold one's own claims and opinions to account by supporting them with evidence and sound reasoning, and avoid biases in one's own reasoning (Fisher & Scriven, 1997). It also demands the ability to predict, both accurately and logically, the consequences of what one is proposing. It requires an ability to explain the evidence and reasoning that leads one to make a claim (Newmann, 1990) and includes the capacity to rebut challenges to one's argument, but also to acknowledge the potential limitations of it (Siegel, 1980).

Strand 3   Decision-making

While related to problem-solving, decision-making is distinct in that it only necessarily requires the analytical and evaluative – rather than the generative or creative – aspects of problem-solving, thus aligning more neatly within a framework of critical thinking.

Aspect 3.1   Identifies criteria for decision-making

To make an effective decision, one first needs to understand the problem or situation about which a decision needs to be made, in order to derive criteria for judging the decision (Ennis, 1985; Moore, 2010). Understanding the criteria for a decision, therefore, requires not only the analysis of the current situation in terms of constraints and demands but the ability to recognise what would constitute an ideal outcome (Facione, 1990; Lipman, 1987).

Aspect 3.2   Evaluates options

Having established, or been given, criteria against which to judge possible conclusions, an ability to analyse and evaluate the strengths and limitations of each possible course of action is fundamental to decision-making (Ennis, 1985) and an aspect of applied critical thinking (Glaser, 1941). It involves assessing how well certain options will satisfy the demands of a given challenge or problem while still operating within the conditions or constraints imposed by the situation (Jimenez-Aleixandre & Puig, 2012). Even when all available options have been evaluated, an ideal solution may still not emerge; a crucial aspect of evaluating options, therefore, is determining which option will 'increase the probability of a desirable outcome' (Halpern, 1998).

Aspect 3.3   Tests and monitors implementation

Having made a decision, or come to a conclusion, after formulating a sound theoretical justification for it (see Aspect 2.3: Justifying arguments), a critical thinker tests the effectiveness of their decision, by monitoring its actual impacts and implications (Ennis, 1985; Glaser, 1941; Sternberg, 1986). This requires the ability to analyse objectively and accurately the positive and negative effects of a decision or conclusion, comparing these results or feedback against the intended outcomes, fairly identifying factors that may be causing any unintended and/or undesirable outcomes, and re-evaluating the decision or conclusion, making adjustments where possible.

3 REFERENCES

Bent, M., & Stubbings, R. (2011). The SCONUL seven pillars of information literacy: The core model. In SCONUL (Ed.), *SCONUL Working Group on Information Literacy*. SCONUL.

Brookfield, S.D. (1997). Assessing critical thinking. *New Directions for Adult and Continuing Education*. *75* (Fall), 17−29.

Dewey, J. (1933). How we think. A restatement of the relation of reflective thinking to the educative process (Rev. ed.). D. C. Heath.

Ennis, R.H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*, *43*(2), 44−48.

Ennis, R.H. (2018). Critical thinking across the curriculum: A vision. *Topoi*, *37*, 165−184.

Facione, P.A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction*. California Academic Press.

Facione, P. (2015). *2015 Update on the critical thinking mindset from Delphi Report principle investigator, Dr. Peter Facione*. https://insightassessment.com/wp-content/uploads/ia/pdf/Delphi-Research-Table-1-Ideal-Critical-Thinker.pdf

Fisher, A., & M. Scriven (1997). *Critical thinking: Its definition* and *assessment*. Edgepress and Centre for Research in Critical Thinking, University of East Anglia.

Glaser, E.M. (1941). *An experiment in the development of critical thinking*. Columbia University Teachers College.

Grafstein, A. (2017). Information literacy and critical thinking: context and practice. In D. Sales & M. Pinto (Eds.), *Pathways into information literacy and communities of practice* (pp. 3–28). https://doi.org/10.1016/B978-0-08-100673-3.00001-0

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist*, *53*(4), 449–455.

Jimenez-Aleixandre, M.P., & Puig, B. (2012). Argumentation, evidence and critical thinking. In B. Fraser, K. Tobin & C. McRobbie (Eds.), *Second international handbook for science education* Vol 2 (pp. 1001–1017). Springer.

Kuhn, D. (1999). A developmental model of critical thinking. *Educational Researcher*, *28*(2), 218–239.

Lipman, M. (1987). Critical thinking: What can it be? *Analytic Thinking*, *8*(1), 5–12.

McPeck, J.E. (1981*). Critical thinking and education*. Routledge.

Mezirow, J. (2009). Transformative learning theory. In J. Mezirow & E. W. Taylor & (Eds.), *Transformative learning in practice: Insights from community, workplace, and higher education* (pp. 18–32). Jossey-Bass.

Newmann, F.M. (1990). Higher order thinking in teaching social studies: A rationale for the assessment of classroom thoughtfulness. *Journal of Curriculum Studies*, *22*(1), 41–56.

Ong, T., Normand, M.P., & Merritt, S.J. (2018). Using equivalence-based instruction to teach college students to identify logical fallacies. Behavioural Interventions, 33(2), 122–135.

Paul, R.W., & Elder, L. (1999a). Critical thinking: Teaching students to seek the logic of things. *Journal of Developmental Education*, *23*(1), 34–35.

Paul, R.W., & Elder, L. (1999b). Critical thinking: Teaching students to seek the logic of things, Part 2. *Journal of Developmental Education*, *23*(2), 34–35.

Paul, R.W. & Elder, L. (2007). *Critical thinking competency standards:* Standards*, principles, performance indicators, and outcomes with* a *critical thinking master rubric*. http://www.criticalthinking.org/files/SAM_Comp%20Stand_07opt.pdf

Paul, R.W., Elder, L., Bartell, T. (1997). *A brief history of the idea of critical thinking*. https://www.criticalthinking.org/pages/a-brief-history-of-the-idea-of-critical-thinking/408

Siegel, H. (1980). Critical thinking as an educational ideal. *The Educational Forum*, *45*(1), 7–23.

Sternberg, R. J. (1986). *Critical thinking: Its nature, measurement, and improvement*. National Institution of Education. https://files.eric.ed.gov/fulltext/ED272882.pdf

Thomas, K., & Lok, B. (2015). Teaching critical thinking: an operational framework. In M. Davies & R. Barnett (Eds.), *The Palgrave handbook of critical thinking in higher education* (pp. 93–105). Macmillan.

Watson, G. & Glaser, E.M. (1964). *Watson-Glaser critical thinking appraisal manual*. Psychological Corporation.