
CHAPTER

1

Critical Thinking Defined

As an educator, you may have had a professional development session or graduate course on “critical thinking.” Or perhaps the most exposure to the term you’ve had is the inclusion of the term in the “4Cs”—Creativity, Collaboration, Communication, and, yes, Critical Thinking. The term “critical thinking” is commonly used interchangeably with other words, such as “student engagement,” “creativity,” or “higher-level learning.” And let’s not forget that active engagement alone is not a good qualifier—one could be actively engaged in misconceptions or irrationality. A jumbled reference to Bloom’s Taxonomy (1956 terms (analysis, synthesis, and assessment) is typically seen as evidence of critical thinking ability.

The perception that we still do not understand the concept well enough to determine how teaching critical thinking skills can be integrated into the curriculum is one obstacle that has kept us from making more progress in critical thinking education

over the past several decades. This paralysis can be traced back, at least in part, to debates that have taken place within the academic community of critical thinkers regarding how the term should be defined. However, even though these discussions are well-intentioned and helpful, they should not obscure the fact that there is widespread consensus regarding the skills that constitute critical thinking, as well as substantial research regarding how those skills can be taught effectively. For instance, critical thinking requires a more organized way of thinking than other types of thinking. “Logic” is the term that is most used to describe this type of productive and structured thinking; however, logic actually describes a number of different systems for reasoning systematically.

There are two kinds of logic: formal and informal. Formal logic comprises words and concepts, which are reduced to symbols that can be manipulated in the same way that numbers and symbols are manipulated in mathematics. Informal logic is a form of logic that allows us to consider the meaning of words rather than reducing them to symbols that fit into a structure. Formal logic is extraordinarily powerful; just ask any computer programmer about its capabilities. However, we can also systematize our reasoning by using informal logic. There are also a number of graphical systems that can be used to map out logical relationships. Some of these systems are simple enough to be picked up by young learners, and they can be utilized in any subject area. People who are skilled at critical thinking must also be adept at translating spoken and written language into precise statements that can be built into a logical structure. This is because the majority of the communication we need to think critically about involves everyday human language as opposed to machine code. With enough practice, students will be able to perform this type of translation on anything from historical or literary documents

to scientific ideas and mathematical proofs, although this translation process involves an element of art as well as science.

Systematic efforts to integrate critical thinking skills into our schools have come up short. Additionally, there is a lack of understanding regarding how to assess it, as well as whether schools wish to prioritize assessing critical thinking. If educators believe they already know how to teach critical thinking in their classrooms, a newly constructed assessment or evaluation will be viewed as a pointless exercise that should be carried out with extreme caution and consistency. Some educators conflate critical thinking with active participation, engagement, or “cooperative learning.” Others will claim that familiarity with Bloom’s Taxonomy or Howard Gardner’s notion of multiple intelligences equates to the ability to grasp critical thinking. Some educators will equate it with a focus on learning styles, concept maps, or any other tool, aspect, or dimension of learning. Still others will associate critical thinking on the whole with a subset of it. As a result, some will promote different points of view (and take that to be the whole of it). Some will emphasize the need of realizing one’s own assumptions. Certain individuals will emphasize the importance of verifying information sources. Some will place a premium on conceptual analysis. We really need a holistic view or at least a realistic understanding of how to build critical thinking while teaching the concepts of a particular discipline.

I believe it is prudent to begin with a definition of critical thinking. In Peter Facione’s 1990 work, he was able to extract a handful of definitions. I’ll summarize them here, then we’ll settle on one concise definition. To begin, here is a lengthy excerpt of Facione from the California State Universities and Colleges website:

The link between language and logic . . . the capacity to evaluate, criticize, and advocate for ideas, to reason inductively and

deductively, and to reach factual or judgmental conclusions based on good inferences made from clear expressions of knowledge or opinion . . . (or develop) the ability to discern truth from judgment, belief from knowledge, and elementary inductive and deductive reasoning skills, including an awareness of language and thought's formal and informal fallacies. (Facione, 1990)

In 1990, the American Philosophical Association sponsored a Delphi research study to determine key critical thinking skills based on the consensus of experts from the humanities, sciences, social sciences, and education in the United States and Canada. According to the APA Delphi Report, critical thinking is defined as “the act of deliberate, self-regulatory judgment. This procedure took evidence, context, conceptualizations, techniques, and criteria into account” (Facione, 1990). Facione recognized six critical thinking abilities as essential:

- **Inference:** To identify and secure the elements necessary to arrive at reasonable conclusions; to formulate conjectures and hypotheses; to consider pertinent information and to mitigate the consequences of data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation
- **Explanation:** To articulate the conclusion of one's reasoning; to justify that conclusion in terms of the evidentiary, conceptual, methodological, criteriological, and contextual considerations upon which the conclusion was based; and to offer one's conclusion in the form of convincing arguments
- **Evaluation:** To determine the credibility of statements or other representations that are accounts or descriptions of an individual's perception, experience, situation, judgment, belief, or opinion; and to determine the logical strength

of actual or intended inferential relationships between statements, descriptions, questions, or other forms of representation

- **Self-regulation:** The conscious monitoring of one's cognitive activities, the elements used in those activities, and the results generated, most notably by applying analytical and evaluation skills to one's own inferential judgments with the goal of challenging, confirming, validating, or correcting either one's reasoning or one's results
- **Interpretation:** The capacity to perceive and communicate the meaning or significance of a diverse range of experiences, circumstances, data, events, judgments, norms, beliefs, rules, procedures, or standards
- **Analysis:** To ascertain the intended and actual inferential links between statements, questions, concepts, descriptions, or other forms of expression intended to reflect belief, judgment, experiences, justifications, information, or views

Concise Definition of Critical Thinking

Most scholars agree that critical thinking comprises an interpretation or analysis, typically followed by evaluation or judgment. It implies that learners must have mastered some subject matter before engaging in critical thinking, implying that critical thinking cannot occur in a vacuum. This type of thinking is challenging and unnatural, and it requires time and effort to master (Nilson, 2011). Teaching can be structured without focusing on mechanization of education. We must disentangle these two conceptions. We can improve education's quality by avoiding an obsession with knowledge and skills. More on this later.

This is our concise and abbreviated definition: *interpretation or analysis, followed by evaluation or judgment.*

Critical Thinking Is Not All Procedural

At this point you might be already thinking that critical thinking is very rote and methodical, and that we might minimize and damage creativity by imposing too many constraints on thinking and inferences. I admit that if we are urged to investigate all relevant hypotheses, the influx of options may make judging what is going on more difficult. We may not have enough bandwidth to gain insights if we spend our time tracking assumptions and uncertainties, reviewing the lineage of sources, and checking for logical contradictions.

When people are required to justify their judgments, they are more prone to focus on signs that they can verbalize than the tacit knowledge that is at the heart of expertise. Following the requirements for double-checking assumptions, preserving internal consistency, and so on may foster a passive mindset of avoiding mistakes rather than an active mindset of seeking out new information. With an active mindset, we can do more to make sense of events than we can by blindly accepting others' views and passively following directions. We can be on the lookout for weak signals that others aren't picking up on. Coincidences and probable links can pique our interest. We can be sensitive to things that should have happened but didn't. We could be more mindful.

Curiosity appears to be a common denominator in all these components of critical thinking. A shift in attitude from a procedural to an investigative mindset is one part of critical thinking. All we must do is follow the protocols, according to the procedural mindset. Certainly, we must learn the procedures in most

jobs. However, there are situations when the rules and processes do not apply or would result in flawed outcomes. Procedures are important, but they aren't enough. We must learn the procedures but must not get engrossed in them. We must also look around, not blinding ourselves to common sense and glaring observations.

This transition in thinking from procedural to investigative might be difficult. Procedures provide the foundation or framing for critical thinking. After an event or a report of potential danger, we are accountable to the facts. When there is a tornado heading your way, you act by getting to a safe location. We receive training and even checklists on how to deal with these circumstances. We must think beyond the routines to anticipate what can go wrong and what dangers might arise. Critical thinking drives us to examine the objectives that have been set for us. It's all too easy to get caught up in the stated aims and objectives set forth by an authority. In complex and shifting contexts, however, events may overtake these objectives. Alternatively, we may be confronted with difficult situations that lack clear objectives, forcing us to revise our objectives as we go. We must adapt and improvise not just the strategies for accomplishing the goals, but the goals themselves.

Thus, it is unhelpful and possibly incorrect to speak about critical thinking "abilities." Critical thinking is an integral aspect of most disciplines and subject areas, and if you ask subject matter experts to define critical thinking, you will likely discover much overlap between the responses from mathematicians and historians, and likewise for creativity. Creativity is not a single process, but rather a collection of related but distinct ones. Mathematics creativity is distinct from visual arts creativity. If a student decides to be creative in mathematics by determining that $2 + 2 = 3$, this is not creativity; it is just inaccurate, as the learner is

no longer performing mathematics (unless we're talking about quantum physics, and $2 + 2 = 5$, but that's for a different book). Creativity entails operating on the outskirts of a field while remaining within it.

Similar arguments might be made for other future skills for success, including problem-solving, communication, critical thinking, creativity, and metacognition. There is some indication that students who learn to collaborate effectively in one setting may be more effective in another; thus some transfer of skills is almost certain. Some argue that if we want students to be creative in mathematics, we must explicitly teach creativity in the mathematics context. Or if you want students to think critically about history, you must educate them how to think critically about history. Rather than viewing critical thinking as a generic talent that can be taught in any discipline or subject, schools should utilize it as a “tool for auditing the breadth of the curriculum supplied in any discipline or subject.” This entails ensuring that all disciplines are taught in an epistemically broad manner, as Guy Claxton defines it (Claxton, 2014). Thus, rather than teaching history “as if it were about facts and dates,” it should be taught as an epistemic apprenticeship into the discipline of history, which includes facts and dates, as well as an awareness of bias in historical sources, chronology, and cause and effect. Education is an apprenticeship in thinking, learning, and knowing. It is “epistemic” because it is mostly about these things. We could say that it has to do with developing an epistemic mentality, which is a set of ways to deal with complexity, uncertainty, and difficulty. It also helps people develop an epistemic identity, which is a set of beliefs and attitudes about their own rights and abilities as thinkers, learners, and knowers.

Given the various strategies and opinions surrounding pedagogy, it's surprising how much agreement exists on the necessity of teaching disciplines as single subjects, each with its own

structure and standards, language and logic, views and habits of thought. There have been many attempts at integration, especially with STEM (or STEAM), but in large part our subjects are segmented. Howard Gardiner said, “Mastering disciplines, developing good communication skills, and engaging in polite debate and argument—these have been, and should continue to be, at the forefront of all education. The ancients emphasized the necessity of knowing what is true (and what is not); what is beautiful (and what is not); and what is good (in terms of being a worthy person, worker and citizen). These educational objectives should be long-term” (Gardiner, 2008). A quick note about Gardiner’s statement: he encapsulates the essence of the trivium, the three arts of grammar, rhetoric, and dialectics that Martin Robinson FRSA argues provide the foundation for what John Milton once described as a “complete and generous education.” Additionally, he provides his perspective on what is true (academics), what is beautiful (aesthetics), and what is right (ethics). Gardiner encapsulates the essence of what you might have heard of as the “brain, hand, and heart” of education.

The only way to reform societal, educational, economic, and political systems is through critical thinking. This, I believe, is an eternal undertaking regardless of the place or the period in which we live. Since the dawn of humanity, we have encountered a plethora of issues ranging from trivial to sophisticated. As a result, we require precarious and sophisticated answers. Given the absence of a deductive method to societal advancement, our only alternative is critical thinking, which begins in our classrooms.

This book will examine human psychology principles such as confirmation bias, faulty logic, and fallacies. After setting the backdrop for how the brain works, we’ll discuss how to avoid the errors that frequently lead us to ignore critical thinking. We’ll look at critical thinking through the lens of instructional design for your students. Additionally, we’ll discuss techniques to assist

you in regularly and explicitly teaching critical thinking and how to incorporate it into your daily classroom activities. Additionally, we'll examine what distinguishes thinking, a fundamental human faculty that we take for granted, from thinking well, what it takes to train ourselves in the art of thinking, and how we can channel our natural curiosity in a productive manner when confronted with an onslaught of information. I've already offered numerous critical thinking conceptualizations. Critical thinking is about making decisions based on a systematic review of data about an issue or topic, rather than on gut instincts, unsupported assertions, views, or emotions. Remember the concise version I offered earlier: *interpretation or analysis, followed by evaluation or judgment.*

Klein produced an essay covering two waves of critical thinking, providing a broader viewpoint and a form of critical thinking history (Klein, 2011). The first wave concerns our mental processes. The second wave is all about discovering new things. Each wave has its own worth. We might be able to identify better techniques to improve critical thinking and attain a more balanced picture of it if we can untangle them. The first wave focuses on reducing mistakes and faulty reasoning. Critical thinking should be complete and methodical, as well as rigorous, consistent, and logical. It should also be based on solid data. The second wave refers to critically thinking about what is going on around us rather than accepting what others tell us is going on. It's about exercising our critical thinking skills and asking oneself, "Is this explanation plausible?" So yes, critical thinking is rooted in logical reasoning at its core, but has far-reaching impacts on imagination, creativity, intuition, and insight.

While the concept of critical thinking dates back to the fifth century BCE, the 1983 release of *A Nation at Risk*, which detailed decreases in national academic performance as assessed by

standardized testing, sparked renewed attention. Even since the renewed focus on critical thinking since the 1980s, our education system has been sluggish to respond. To be fair, more than just educational systems are to blame. The machinery and processes of education are led by people who are held back by their own cognitive biases. Critical thinking is hard—it's in the name.

