# *Developing Advanced Critical Thinking Skills in Education Systems: Higher-Order Thinking Processes in an Era of Rapid Change*

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**Abstract**
This paper examines the close connections between critical thinking and cognitive development, logic, and emotionality and the growing importance of promoting and developing higher order thinking processes in education systems and work environments in an era of rapid change. Students and employees require advanced critical thinking skills to carefully evaluate and effectively use vast amounts of information and data from a growing number of sources. Educational institutions in many countries have given priority to the development of critical thinking skills in curricula, most notably at the university level. Teachers at all levels of education have been advocating the use of critical thinking skills in classes in recent years. Critical thinking skills can be improved by training students in the use of Socratic dialogue and by promoting an advanced self-awareness of thinking processes (Braun, 2004). Logical reasoning, problem-solving and related skills are important elements in critical thinking, but emotions may also play an important role in thinking processes. Emotions may influence logical, objective thinking and a certain level of emotional self-awareness and self-control may enhance critical thinking processes (Ruggiero, 2004). Critical thinking has become an important topic in education systems in many countries, and the need for self-aware, resilient, and resourceful students and employees who can think critically, flexibly, creatively, and independently is increasing.

Keywords: Critical Thinking, Cognitive Development, Logic, Emotions

## Introduction

This paper explores the close relations between critical thinking and cognitive development, logic, and emotionality and the increasing importance of promoting and developing higher order thinking processes in education systems and work environments in an era of rapid change. The ability of students and employees to think critically is becoming increasingly important in a complex global economy and interconnected international society. Educators and managers require a detailed understanding of critical thinking and need to foster its development in students and employees so that organizations and societies can function effectively, logically, and efficiently. Critical thinking encompasses a broad range of skills, abilities, and habits and is connected to and influenced by cognitive development, logic, and emotionality (Schwarze & Lape, 2001). An understanding of critical thinking requires a multidisciplinary approach. In an era of accelerating change in technology, society, and work, students and employees need advanced critical thinking skills to carefully evaluate and effectively use exponentially growing amounts of information and data from a steadily increasing number of sources (Petrucco & Ferranti, 2017). Students and employees need to identify false information and to modify hypotheses, theories, and beliefs based on new, reliable information. Critical, evidence-based thinking based on sound reasoning is an ongoing process which examines beliefs, identifies contradictions and inconsistencies, and continually tests hypotheses (Braun, 2004). Critical thinking is at the core of scientific reasoning and innovation and is necessary for the maintenance and continual improvement of an increasingly complex global society.

## Definitions and Characteristics of Critical Thinking

The concept of critical thinking has become so all-encompassing that it is difficult to define with one single, simple, complete definition. Critical thinking is a powerful, empowering model of thinking and logical reasoning, but it may also be difficult to comprehend and to teach without a great deal of self-reflective study and mental effort. Critical thinking may, in part, be defined and classified as a form of higher-order thinking that is involved primarily in the evaluation of arguments in a purposeful manner enhanced by an objective self-awareness of one's own decision-making processes (Astleitner, 2002). Indeed, purpose must be a key element of higher-order thinking and complex decision-making processes. Role modeling can be used to explain the process of critical thinking which can be defined as a highly structured method of thinking which is particularly useful when making decisions in a high-stress environment (Carroll-Johnson, 2001). Logical structure is a key component in critical thinking, giving it a strong but flexible framework with a consistent level of validity and reliability that can be applied to any challenging situation.

Meta-cognition, an objective self-awareness and understanding of one's own thinking processes, plays an important role in critical thinking (Braun, 2004). Critical thinking includes some level of ability to self-monitor one's own thought processes and to identify logical inconsistencies, contradictions, and various forms of bias that may distort the reasons given for certain choices. Class discussions, debates, and independent research assignments can aid in the development of critical thinking skills (Hermond & Tanner, 2020). Some more detailed and extended definitions of critical thinking deal primarily with the analysis of arguments and facts, and the identification of common logical fallacies. For example, critical thinking may be defined as the ability

to distinguish between evidence-based facts and statements of value, and as the ability to identify bias and unstated assumptions (Duplass & Ziedler, 2002). Critical thinking is also described and defined with detailed lists of attributes and general human characteristics such as inquisitiveness, the ability to seize new opportunities, open-mindedness, flexibility in thinking and behaviour, persistence and attention to detail among many others (Cheung, Rudowicz, Kwan, & Yue, 2002). Some of the multiple terms used to describe and define critical thinking may be ambiguous and difficult to define precisely. Critical thinking is a complex concept, a higher-order thinking process used to make logical choices and decisions, and an ability which defies simple definitions.

**Cognitive Development and Critical Thinking**

Cognitive development in children is linked to a frequent questioning of the surrounding environment and to the development of basic critical thinking skills (McDaniel, 2004). Aspects of critical thinking such as problem-solving skills can be introduced into the lower grades in schools. Teachers can create classroom environments in which elementary school pupils can start to acquire the habits of interpreting, analyzing, evaluating, and explaining various situations and phenomena (Leasa, Corebima, & Batlolona, 2020). The natural curiosity of children can be used to support the development of basic critical thinking skills and of a more sophisticated and persistent examination and reevaluation of the surrounding environment by children. If critical thinking is to become ingrained as a lifelong habit of active, purpose-driven, self-reflective thinking and behaviour, then appropriate aspects of critical thinking should be taught as early as possible in schools. The methods of knowledge transmission in schools can limit or enhance the ability to think critically and independently (Manzo, 1998). Schools can discourage critical thinking by avoiding controversial topics and by putting an emphasis on only one correct answer for each question posed in class. Critical literacy, the ability to question and interpret texts and stories in different ways, can be taught using fairy tales (McDaniel, 2004). Students need to learn how to interpret information from a variety of viewpoints and to be able to modify or change opinions and beliefs to adapt to a rapidly changing and increasingly technological world.

In addition to storytelling and literature, art studies can be used to promote cognitive development and critical thinking in young students. For example, drawing pictures can be combined with the teaching of narratives and social studies (Coufal & Coufal, 2002). Art is a system of symbols that children can use to express feelings and concepts that they may not yet be able to clearly communicate in their own words. Social interaction and collaborative activities and projects enhance cognitive development and the ability to question aspects of the surrounding environment (Thayer-Bacon, 1997). A significant amount of knowledge about the world is acquired through social interaction. Language and art are systems of communication based on symbols and are closely related to cognitive development and critical thinking.

## Logic and Critical Thinking

Critical thinking is essential for the development of formal logic and the use of deductive and inductive reasoning (Kirby & Goodpaster, 2002). A desire to change or modify existing viewpoints and to explore alternative explanations makes the use of logical arguments possible. Valid arguments and formal reasoning can be developed through the Socratic method, a process of questioning, analyzing, evaluating, comparing, and reinterpreting viewpoints and understandings (Schwarze & Lape, 2001). A clear link exists between critical thinking skills and an understanding of formal logic and the ability to apply it to a wide range of situations. Logical arguments are made possible by critical thinking skills (Duplass & Ziedler, 2002). Advanced critical thinking skills are essential for effective scientific reasoning and continual innovation.

## The Influence of Emotions on Critical Thinking

Humans are not completely rational creatures devoid of emotions. The temporary moods and emotions experienced by an individual may fluctuate frequently and influence personal decisions, opinions, and attitudes. Emotions may influence logical, objective thinking and a certain level of emotional self-awareness and self-control may enhance critical thinking processes (Ruggiero, 2004). A person who can objectively evaluate his or her own emotional state and who can exercise some self-control may also be capable of monitoring his or her own thinking processes and of self-evaluating his or her own opinions and beliefs. Extreme or violent emotions and emotionally charged language can inhibit the use of critical thinking and logic (Schwarze & Lape, 2001). Although emotions can have a negative impact on critical thinking and logical reasoning, an overreliance on logic may also result in negative outcomes. For example, managers who make decisions based on logic alone may not have enough empathy to understand the emotional and motivational needs of workers (Steininger, 1994). Emotions have an impact on critical thinking that needs to be acknowledged and systematically evaluated.

## Developing Higher-Order Thinking Processes in Education Systems

Education systems in many countries have given priority to the development of critical thinking skills in curricula, most notably at the university level. Critical thinking has become an important topic among educators, and the importance of its development in college students in the United States has been recognized as a national educational goal that is essential for the success of the economy (Braun, 2004). Critical thinking skills are essential for students and workers in a globalized world shaped by rapidly changing technology and an exponentially increasing flow of information and data.

Collaborative learning is a common theme in many university courses that emphasize practical project-based learning connected to real-world outcomes. Collaborative team learning projects combined with real-world data collection, consulting, and problem solving are an effective method to develop critical thinking skills in university business students (Canziani & Tullar, 2017). Some online learning platforms can be as effective as traditional classroom settings. Critical thinking skills can be developed in interactive, collaborative learning environments, including online university courses that require self-reflection (Hermond & Tanner, 2020). University courses can also promote critical thinking, rational analysis, and objective evaluation through class discussions and

debates.

Problem-solving exercises that require the use of design, creativity, and technology can improve critical thinking skills (Matthee & Turpin, 2019). The ability to evaluate the truth, accuracy and value of online information and online sources is becoming increasingly important. A clear methodology combined with increased self-awareness of thinking processes allows students to improve critical thinking skills (Petrucco & Ferranti, 2017). University courses and research projects connected to real-world problems and digital information literacy prepare graduates for careers in a constantly changing, evolving, and increasingly technological work environment.

## Conclusion

In conclusion, critical thinking is of vital importance in both educational and working environments in an increasingly complex, interconnected, and technological world. An objective awareness of one's own thinking processes and patterns and the ability to engage in Socratic dialogue are key aspects of effective critical thinking (Braun, 2004). Cognitive development is influenced and enhanced by critical thinking skills. Logical reasoning, problem-solving skills and related skills are important elements in critical thinking. The role of emotions in critical thinking needs to be acknowledged, monitored, and self-evaluated. Critical thinking has become an important topic in education systems in many countries, and the need for self-aware, resilient, and resourceful students and employees who can think critically, flexibly, creatively, and independently is increasing.

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