

CRITICAL THINKING :REVIEW OF THEORIES AND MODELS

Attalah Mohamed AlatawiMohdZuriGhaniAswatiHamzah*

Abstract

The future of nations and their progress, as far as science and developed technology are concerned, largely depend on the interest in and care for the gifted and talented student and on providing the suitable climate to launch their creative potentials and develop the critical thinking skills .This paper shows an introduction to the notion of theoretical framework based on Bloom's Taxonomy of Learning Domains, Guilford Structure of Intellect Theory, Piaget Theory of Cognitive Development, Richard Paul Theory, Robert Ennis Theory, Beyer Theory, Delphi's Model and Watson's and Glaser's Model

Keywords: Critical Thinking, Critical Thinking Theories

* University Science Malaysia, Penang, Malaysia

Introduction

Critical thinking is considered to be a higher order type of thinking; non-algorithmic, complex mode of thinking that often generates multiple solutions. Using Bloom's classification, the lower levels of Blooms taxonomy such as knowledge could be considered to be the low-order thinking skills, while the higher levels of Blooms taxonomy such as analysis, synthesis and evaluation, could be considered to be the higher-order thinking skills. The multiple elements of critical thinking combined give rise to other skills, including but not limited to, problem solving, inferring, and estimating, predicting, generalizing, and creative thinking. Therefore, problem solving is preceded by critical thinking.

Critical Thinking Theories and Models:

1. Bloom's Taxonomy of Learning Domains

Bloom categorized the human thinking abilities to six different domains (figure 1): a) recalling/remembering; b) understanding; c) applying, d) analyzing, e) evaluating; and f) creating. The Bloom's learning domains are arranged in ascending order of complexity with the simplest learning domain being the recalling/remembering, and the most complex is the creating domain.

Each learning domain is a prerequisite for its subsequent learning domain, and thus, any successful learning should encompass all of the Bloom's domains of learning. Figure 1 illustrates the six domains of Bloom's Taxonomy and their ascending interrelationship.

The critical thinking abilities are nested within the upper three levels of Bloom's taxonomy- analyzing; evaluating, and creating. Therefore to advance to the critical thinking ability, it is necessary to master the lower three levels of Bloom's Taxonomy- recalling, understanding, and creating.



Figure 1: Bloom categorized the human thinking abilities, (<https://ar.wikipedia.org/wiki>, 2014)

2. Guilford Structure of Intellect Theory

Guilford categorize the mental processes to three main dimensions (Figure 2):

- 1) Operation, which include five intellectual processes: a) cognition; b) memory c) divergent production; d) convergent production; and e) evaluation.
- 2) Content dimension, which aims to apply the six intellectual operations: a) visual; b) auditory; c) symbolic; d) semantic; and e) behavioral.
- 3) Product dimension, which contains the products of applying the six intellectual operations using the content tools. Guilford arranged the product dimension into six levels in order of increasing complexity: a) units; b) classes; c) relations; d) systems; e) transformations; f) implications.

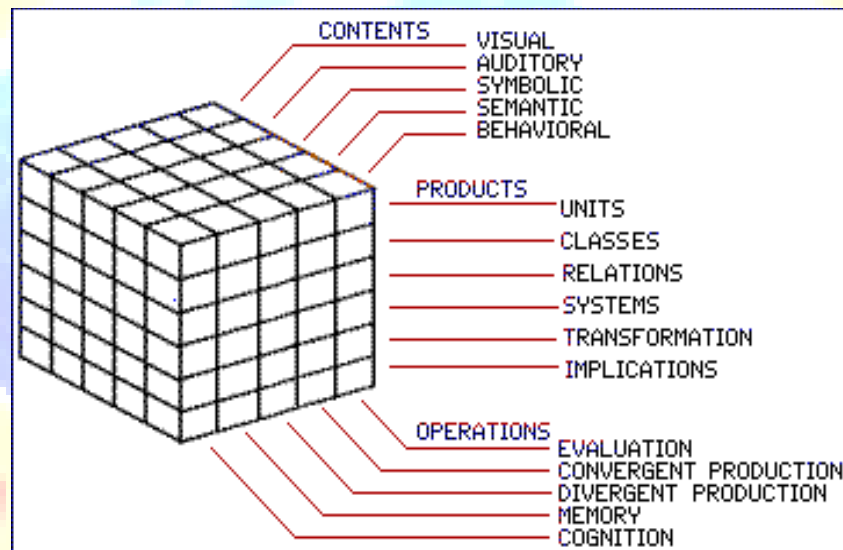


Figure 2: Guilford categorize the mental processes (<http://www.xmind.net/m/7CHc/>)

Therefore according to the Guilford Structure of Intellect Theory, there about 150 components for intellectual thinking: Operations (5) x Content (6) x Products (5) = 150 (Abo Hatab and Othman, 1978).

According to Guilford, the critical thinking is an evaluation process, and thus, it is an operational process that follows competency in cognition, memory, knowledge, understanding, and inference. Moreover, evaluation is a subject to standardization according specific metrics that define certain criteria (Ali, 2009).

3. Piaget Theory of Cognitive Development

Despite the fact that Piaget did not use the word “critical” in his theory of Cognitive Development, there is a clear similarity between Piaget description of the Formal Operational Stage and our current knowledge about critical thinking, which include ability to make generalizations, creation of new possibilities, and rebuttal of prejudgments (Meyers, 1993). The main goal of pedagogy according to Piaget is to create well rounded individuals whom are capable of creating new inventions, and not only understanding and reusing older inventions, which were made by previous generations. Moreover, Piaget describes the Formal Operational Stage as the ability to weigh information and evidence, and not to accept ideas without proper analysis and judgment (Elkind, 1970).

Piaget describes the adaptation of individuals as a process which includes accommodation and assimilation. He defines accommodation as the ability of an individual to integrate situations/information from the outside environment with his/her own intellectual composition. An example on this is to use new, digital technologies for setting a personal calendar instead of using an agenda. On the other hand, Piaget defines assimilation as the ability of the individual to bring change to his/her thinking guidelines to integrate new situation/information from the surrounding environment. An example on assimilation is changing the mindsets of personal behavior to address global warming.

Another way to understand accommodation and assimilation is to consider accommodation as the personal gadget that reflects the thinking processes of the individual, while the assimilation as the decoding of other’s opinions. Therefore, having the ability to equally integrate the processes of accommodation and assimilation in one’s life is an indicator that the individual is most likely capable of making sound thinking and good decisions. By continuously practicing accommodations and assimilation, the ability of the individual to refrain from being bias, making rough generalizations, or adopting false logical arguments is minimized. Piaget stresses on the creating an equilibrium between assimilation and accommodation as this is necessary to achieve the proper interaction between the individual and the surrounding environment, and therefore, leads to the ability of the individual to attain a proper intellectual balance that leads to critical thinking.

4. Richard Paul Theory (Paulian Critical Thinking)

In constructing the Paulian Critical Thinking Theory, Richard Paul(1984) started by figuring out the minimal conditions for establishing his critical thinking theory. Paul attempted to analyze the driving force and obstacles for critical thinking. Therefore, he established his theory on the following premises: a) It is human nature to think; b) Human thinking is greatly influenced by internal and external factors such as prejudice, illusion, ignorance, and self-deception; and c) it is necessary to intervene to improve the thinking process.

Paul also distinguished critical thinking in the “strong-sense” from the critical thinking in the “weak-sense”. To think in a strong-sense means that the individual develops and practices fair-mindedness, and thus he/she will treat all thinking with high standards, including those ideas that opposes his/her thinking. The person practicing strong-sense thinking constantly employs analysis and reasoning for his/her thinking and for others. On the other hand, to think in a weak-sense means to employ a prejudice and irrational thinking processes in an attempt to support one’s own position and attack or undermine the thinking of others.

Another feature in the Paulian theory is that it does not recognize nor manifest the difference between critical thinking and creative thinking. Paul described both critical and creative thinking as being qualitative and that the difference between them is can be manifested in the degree of their application and concentration. Therefore, Paul suggested that the all curricula, and pedagogy in general, should stress the understanding that critical thinking leads to creative thinking, and creative thinking leads to critical thinking.

In his work, Paul additionally divided the thinkers to three categories: a) critical thinker; b) selfish thinker; and c) non-critical thinker. The critical thinker is described as the an individual with logical reasoning, a person with no prejudice, and has strong thinking abilities. The selfish thinker is describes as the an individual with weak thinking abilities, a person who concentrates on self-gain, and accomplishing personal goals utilizing ill methods which are directed toward manipulating emotions and thinking of others. The non-critical thinker is described as an individual who has weak thinking abilities and it is easy for others to manipulate his/her emotions and thinking (Al-Harthy, 1998).

Paul also reasons that the critical thinking abilities progressively improves throughout the development of the individual. The critical thinking abilities first develop at ages between 11-12 years old, and do not cease until the age of 15 years old, which is then gradually progresses until age of maturity, at which it become semi-stabile (Al-Hamory& Al-Wahr, 1996).

5. Robert Ennis Theory

Ennis (Ennis, 1985) is considered one of the leaders in critical thinking movement. Ennis defines critical thinking as the thinking that is focused on what to do or believe upon a certain situation or an event. Critical thinking is comprised of two main processes: a) it is a mental process that leads to sound, logical decisions in support or refute of an idea/logic; b) It is a strategic, process that is facilitated by conscious, elaborative thinking in order to reach sound decisions and conclusions.

Ennis(1985) further elaborated on requirements for sound decisions and conclusions by categorizing the judgments into two categories: (a) the suitability of the decision(s) on already established mental guidelines and knowledge; (b) The usage of existing knowledge and mental guidelines in fostering and reasoning the new decision(s). This is somewhat similar to the accommodation and assimilation processes that Piaget described .

Ennis (1985) further described the critical thinking abilities as being more rigid, and more comprehensive than the upper three thinking abilities in Bloom's taxonomy-analysis, evaluation, and creation. According to Ennis, notice and reason are two critical thinking abilities which should be taken into account in addition to the abilities described by the pedagogical Bloom's taxonomy. The usage of analysis and reasoning is strongly related to the relationship of the individual with others, and their application of is uniquely contingent on the situation/event. As such, Ennis calls for application and usage of critical thinking abilities at all stages of schooling, and further argues that the critical thinking abilities are more beneficial at all stages of education than the upper levels of Bloom's taxonomy-analysis, evaluation, and creation. Ennis argues that the critical thinking abilities are a main requisite for the application of the scientific process as critical thinking abilities are considered an important part of the scientific inquiry and processes.

Thus, a critical thinker is most likely to possess the ability for scientific inquiry and application. This is due to the ability of the objectivity of the critical thinker and his/her abilities to logically, and rigor evaluation of the information and data according to specified standards and regulations. The critical thinker can also excel in ability to compare and ability to finding alternative solutions, and thus, the critical thinker can be trusted in reaching sound and effective solutions. According to Ennis, the critical thinking process is comprised of three distinct stages (Al-Hamory and Al-wahr, 1996):

- a) Basic clarification. This stage includes identifying the problem, setting the goals, and formulating adequate questions, and ability to generate hypothesis.
- b) Data Judgment: This stage included the ability to objectively judge reliability and suitability of the data, and ability to differentiate between the primary and secondary/other factors that affect the situation.
- c) Inferences: This stage include the ability to reach a solution to the situation and ability to forecast possible outcomes. It also includes the ability to scrutinize the results and to evaluate the evidence.

Ennis(1985) suggested that the critical thinking abilities is directly related to cognitive and affective processes (Kennedy et al, 1996). Ennis Further identifies twelve critical thinking abilities: 1) Understanding the problem; 2) ability to identify the ambiguity in the reasoning; 3) identifying contradiction(s); 4) ability to recognize the interrelationship between the problem and the result/solution; 5) ability to identify a focused problem/issue; 6) ability to assess the application of the problem/solution; 7) ability to scrutinize the data; 8) ability to judge if the solution/conclusion is adequately supported; 9) ability to identify the problem; 10) Ability to identify hypothesis; 11) Ability to recognize adequate definition(s); 12) ability to identify the suitability and accuracy of the statements (Kennedy et al, 1991).

As for the teaching aspect of the critical thinking, Ennis confirmed that acquiring skills in logical reasoning is directly linked to acquiring critical thinking abilities. Ennis also supports the teaching methodologies of individualized learning, which is linked by clear outline on the critical thinking abilities. Ennis further recognized the importance of theoretical and practical approaches for enhancing critical thinking abilities. Ennis is also a supporter in publicizing the

critical thinking as in integrating it into all stages of education, through which the students are trained on critical thinking in the school and can then utilize it in their daily lives outside of the school (Ennis, 1985).

6. Beyer Theory

According to Beyer, critical thinking has three aspects: cognitive, skills, and direction. The three aspects of critical thinking interact within the individual and holistically forms the critical thinking abilities. The cognitive aspect includes the prior knowledge of the individual, and the ability of the individual to recognize and utilize the possible source(s) of related information. The relations with others also directly impact the cognitive aspect of the critical thinking as it relates directly to the acquired social experiences, which are directly linked to the ideology of the individual. On the other hand, the skill aspect of critical thinking is comprised of the ability of the individual to organize, utilize, and evaluate his/her cognitive abilities (Kneedler, 1986). The direction aspect, such as the love to learn and eagerness to advance, is the third aspect of the critical thinking, and comes to play as a subsequent element to the cognitive and skill aspects.

Beyer considers problem solving and decision making as more comprehensive thinking processes than critical thinking. Beyer argues that problem solving and decision making are strategic thinking abilities, each of which is comprised of a collection of processes that the individual utilizes regularly and sequentially. Critical thinking, on the other hand, is a collection of processes that can be utilized individually, collectively, or in dispersive collections. Since critical thinking starts by formulating a hypothesis or an assumption is not analogues to problem solving and decision making. Moreover, critical thinking is a more complex process than problem solving and decision making since it also requires scrutinizing of the applied procedure, data, and results.

Beyer defines ten critical thinking skills (Beyer, 1985): 1) Differentiation between facts that can be proven and non-facts; 2) probing elements that are related to the problem and ability to weed out the elements that are not linked to the problem; 3) ability to evaluate the reliability of the information sources; 4) identifying the accuracy of the information; 5) identifying amphibious information; 6) inferring nested information from a given set of data; 7) ability to sense prejudice

or ill well; 8) ability to identify faulty logic; 9) ability to identify contradictions; 10) ability to evaluate the strength of the evidence or claims.

7. Delphi's Model

In 1990, a group of thinking experts met to discuss the progress of understanding critical thinking. The meeting ended up by a report, Delphi's Report, which reviewed up to date information about critical thinking and means of integrating it into curricula. Delphi's Report lists the primary skills that comprise critical thinking (Facione, 2009):

- 1) Interpretation skill: This skill describes the ability to understand and express a wide range of situations, events, information, judgments, beliefs, processes, rules, and conditions. This skill also contains secondary skills such as categorizing, explain, and inferring.
- 2) Analysis skill: This abilities to formulate connections and relations between statements, questions, principles, and descriptions. The analysis skills are also comprised of abilities to interpret beliefs, judgments, experiences, and justifications. It also includes secondary skills such as ability to evaluate ideas, and formulate and analyze reasoning.
- 3) Evaluation skill: The ability to judge the reliability and it depends on the situation/problem, individual's beliefs, and personal experiences. It includes secondary skills such as abilities to weigh the claims and evidence.
- 4) Inference Skill: This is a skill that describes the ability to reach reasonable hypothesis or results based on the provided information, sentences, principles, evidence, judgments, beliefs, ideas, descriptions, and questions. It includes secondary skills such as searching and finding alternative solutions.
- 5) Explanation skill: It describes the ability to vocalize one's own thinking. It includes secondary skills such as reporting of results, justification of procedures and results, and providing proves.
- 6) Self-regulation skill: This defines the ability of the individual to question, scrutinize, organizing of thoughts and results. It includes secondary skills such as personal scrutinizing and self-correction.

8. Watson's and Glaser's Model

Watson and Glaser (1980) conceptualized critical thinking as a composite of attitudes, knowledge, and skills. According to Watson and Glaser, the critical thinking is comprised of five basic steps: 1) Ability to define the problem; 2) ability to clarify and outline problem by collecting necessary facts and information; 3) formulating possible explanations/hypothesis; 4) exploring a potential solution by selecting a hypothesis for testing; 5) formulating a conclusion. Therefore, Watson and Glaser laid the foundation for the three major pillars of critical thinking: a) ability to identify the problem; b) ability to collect and scrutinize related evidence; and c) formulating and applying good skills to achieve an adequate solution. The work of Watson and Glaser was the foundation for formulating a critical thinking assessment, WGCTA test, which relates critical thinking to academic performance.

Reference

- Abdeen, S. (2014). Theory Concurrent thinking. *Life science journals*,11(12) , USA.
- Abdeen, S. (2015). Think out the box with Concurrent thinking theory. *IPCiRE2015*,US
- Abo Hatab, Fuad. (1978). Thinking: Psychological Study. Cairo, Anglo Egyptian Library, Print #2.
- Al-Hamury, H., Al-Waher, M. (1998). The Development of Critical Thinking and its Relation to Age, Sex, and Study Specialty. *Derasat in Educational Sciences*: 25.
- Al-Harthy, Ibrahim Ahmad (1998). Teaching Thinking. Riyadh, Al-Shukry Library.
- Ali, Ibrahim (2009). Critical Thinking between Theory and Application. Dar Al-Shorouk for Publication and Distribution, Amman, Jordan, Print # 1.
- Beyer, B. K. (1995). Critical thinking. New York: McGraw Hill.
- Elkind, D.(1970).Children & adolescent interpretive Essays on Jean Piaget. Oxford University Press N.Y.
- Ennis, R, H .(1985).A Logical Basis for Measuring Critical Thinking Skills. *Educational Leadership*,43 (2): 44-48.
- Facione, P.(2009).Critical Thinking ;What It Is and Why It Count2. Retrieved[date]from:http://www.insightassessment.com/pdf_files/what&why2006.pdf.
- Kennedy, M., Fisher, M.B. and Ennis, R.H.(1991). Critical thinking - literature review and needed research. In: Idol, L. and Fly Jones, B., Editors, 1991. Educational values and cognitive instruction: Implications for reform, Lawrence Erlbaum, Hillsdale, NJ, pp. 11–40.