

# Higher Order Thinking Skills in the 21<sup>st</sup> Century: Critical Thinking

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**Abstract.** High order thinking skills (HOTS) is significant in the 21st-century learning measure since it requires the advancement of high basic reasoning aptitudes. Critical thinking (CT) skills are one piece of the aptitudes requested in the 21st century. CT skills assume a job in furnishing understudies to manage social, logical, and viable issues successfully later on. This article aims to examine the importance of approving CT skills to answer the challenges of the 21st century. The method use in this a qualitative design with the main source of literature studies on high order thinking skills and critical thinking skills. The process of the literature review method in this study is to choose a review topic; search for literature; collect, read, and analyze literature; write a review; reference. The result of this study that CT skills can assist understudies with improving HOTS by utilizing a learning model of stimulating thinking skills, for instance, a problem-based learning model.

**Keywords:** High Order Thinking Skills, Critical Thinking, 21<sup>st</sup> Century Education.

## 1. Introduction

The 21st century is the century of knowledge, in which the flow of globalization and the openness of information and technology is developing rapidly, bringing changes to all aspects of life. The development of the 21st century requires everyone to equip themselves with skills in facing the era of globalization [1]–[3] higher-order thinking skills are a necessity as a reliable workforce in the 21st century [4]. Larrison (2017) claims that students need to grasp 21st-century skills to enter today's workforce [5]. High Order Thinking Skills include critical, logical, reflective, metacognitive, and creative thinking [6]. HOTS are divided into four groups, namely problem solving, decision making, critical thinking, and creative thinking [7-8]. Partnership for 21st Century Skills emphasizes that one of the life skills that students must-have in the 21<sup>st</sup> century is CT skills [9–11]. Thinking skills are the process of analyzing and evaluating information obtained from observations or experiences, which in the process involve cognitive and affective domains [12]. According to Lai 2011, CT skills are the ability of students to analyze arguments, make conclusions using reasoning, assess or evaluate, and make decisions or problem solving [10]. CT skills in an educational context are an objective decision-making process and self-control that results in interpretations, analysis, evaluation, conclusions, and explanations of evolutionary, conceptual, methodological, criteria, or contextual considerations that underlie the research [13].

CT abilities can be enabled through learning in schools on the grounds that basic reasoning is a 21st-century skill that understudies should have [11], [14]. CT skills are considered as one of the important learning outcomes of learning [15]–[17]. Also, CT skills are very important to be empowered because they can affect student cognitive learning outcomes [18]. Therefore, activities are needed that can develop the skills of 21st-century students to enable students to apply skills in everyday life so that they are ready to face global challenges [19], [20].

This research is a literature study aimed at HOTS descriptive analysis and CT skills. The result of this study can be used as a reference for HOTS conceptual descriptions and critical thinking in 21st-century learning.

## 2. Methods

This research is qualitative research which can be categorized as a literature review study. In this research, the information that must be obtained is about High Order Thinking Skills (HOTS) and Critical Thinking (CT) skills. The process of the literature review method in this study is [21-22]:

1. Choose a review topic
2. Search for literature

The process of searching for literature by filtering based on criteria determined by the authors of each journal taken. The criteria for journal collection are as follows: 1) Compatibility of writing keywords, linkages of writing results and discussion of Hots, critical thinking; 2) Strategies in collecting journals for various literature using accredited journal sites such as Eric, PubMed, Research Gate, Sciendirect, SagePub, and Scholar; 3) Assessing the journal from the abstract whether it is based on research objectives and conducting a critical appraisal with the existing tools

3. Collect, read and analyze literature
4. Write a review
5. Reference

## 3. Result an Discussion

### 3.1. High Order Thinking Skills (HOTS)

The main purpose of HOTS aptitudes is the way to improve the considering abilities understudies at a more elevated level, particularly those identified with the capacity to think fundamentally in accepting different kinds of data, think imaginatively in taking care of issues utilizing their insight, and settle on choices in circumstances. The meaning of HOTS depends on a few suppositions, as can be found in the Table 1:

**Table 1.** Definition of HOTS

Source	Definition
Resnick, 1987	The complex thought perspective of depicting the material, making conclusions, construct representations, analyzing, and building connections by including the most essential mental exercises [23].
Newman, 1990	Clearly distinguish ideas or thoughts, argue well, have the option to take care of issues, have the option to build clarifications, have the option to guess, and comprehend complex issues all the more unmistakably [24]

Lewis & Smith, 1993	High Order Thinking happens when an individual takes new data and data put away in memory and is interrelated and/or sourced and extends this data this data to accomplish an objective or discover potential answer in a confounding circumstance. [25]
King, et al, 1998	Critical, reflective, logical, metacognitive, and creative thinking. Initiated when the individual faces an obscure issue, uncertainty, question, or predicament [26]
Andeson and Kratwohl, 2001	Analysis, evaluation, and creation process[27]
Lopez and Whittington, 2001	Higher-order thinking happens when an individual takes new data and data put away in memory and relates and/or reworks and extends this data to accomplish an objective or discover potential answer in a befuddling circumstance.[28].
Weiss, E.2003	Collaborative, authentic, unstructured, challenging problems[29].
Miri, et al. 2007	Strategy - destination setting; Critical, systematic, and creative thinking are strategies exercises expected to accomplish the expressed objectives [30].
Thomson, T., 2008	Thinking –Non-Algorithmic[31]
Schraw, et al, 2011	Activities that involve mentality with ideas, objects, and situations through analog,elaborative, induvive, deductive, and transformative ways that show an orientation towards complex, generative, evidence-seeking, and reflective knowledge [32].

Based on Table 1, the main purpose HOTS how is the manner by which to improve the considering abilities understudies at a more elevated level, particularly those identified with the capacity to think basically in getting different kinds of data, think innovatively in taking care of an issue utilizing the information they have and settle on choices in complex circumstances. In this article, the researcher summarizes the HOTS concept which is based on several opinions. [33]. The concept of high order thinking is based on several opinions, as can be seen in Table 2:

**Table 2.** The concept of high order thinking is based on several opinions.

<b>Bloom, 1956</b> [34]	<b>Anderson &amp; Krathwol, 2001</b> [27]	<b>Brookhart, 2001</b> [35]	<b>Marzano, 2007</b> [36]
Analysis	Analyze	Analysis, Evaluation and creating	Comparing
Syntesis	Evaluate	Logical reasoning	Classifying
Evaluation	Create	Consideration and critical thinking Problem Solving	Inductive reasoning Deductive Reasoning

<b>Bloom, 1956</b> [34]	<b>Anderson &amp; Krathwol, 2001</b> [27]	<b>Brookhart, 2001</b> [35]	<b>Marzano, 2007</b> [36]
		Creating and creative thinking	Analyzing errors Constructing support Analyzing perspective Abstracting Decisions making Investigation Problem-Solving Ekperimental Inquiry Invention

### 3.2. Critical Thinking Skills

#### 3.2.1. Definitions of Critical Thinking Skills

Thinking is a psychological movement in solving the problem [37]. In this era information and technology corruption, there is an urgent need for students to learn a variety of thinking skills [1]. The ability to think critically has two types, namely high-level thinking and low-level thinking. Higher-order thinking skills consist of logical, reflective, metacognitive, and creative thinking [26]. Several definitions of critical thinking from several figures and articles, which are summarized in Table 3.

**Table 3.** Definition of CT

<b>Expert</b>	<b>Definition</b>
Ennis, 1987	Reasonable reflective thinking focused on deciding what to believe or do not [38]
Lipman, 1998	Thinking that facilitates decisions because it is based on real, self-corrective, and substantive criteria in the context [39]).
Paul, Fisher, Nourish, 1993	A thinking model about any matter, substance, or problem, where the thinker improves the quality of this thinking by skilfully handling the structures inherent in thinking and applying intellectual standards [40].
Scriven, Paul, 1994	The Process of intellectual discipline that actively and skillfully conceptualizes, applies, analyzes, synthesizes, and or generated by, observation, experience reflection, reasoning, or communication as guide for beliefs and actions [41].
Angelo, 1995	Intentional application of high-level, rational thinking skills, such as analysis, synthesis, problem-solving, inference, and evaluation and evaluation [17].
Halpern, 1996	Thinking that is purposeful, reasoned, and goaldirected. This type of thinking involved in solving problems, formulating conclusions, probabilities, and making decision [42]
Santrock, 2011	Critical thinking skills include reflective, productive, and evaluation thinking about and event [43].

Expert	Definition
Rainbolt dywer, 2012	Skill to evaluate good and correct arguments [44].
Stobaugh, 2012	Ability to provide answers that are not memorized[45].
Fachione, 2011	Discipline processes are intellectually active and skilled at conceptualizing, applying to analyze, synthesizing, or information gathered from, or generated by observation, experience, reflection, reasoning, or communication as a guide for belief and action [15].

The definition of CT that have been summarized from various literature are different [13], [38], [46-47] but it has been agreed that critical thinking involves disposition, creative thinking, problem-solving, decision making, and metacognition [48]–[50]. From a portion of the opinions Table 1, the characteristic of CT is solving problems effectively and efficiently and being responsible for making decisions. Butler (2012) presumes that most scientists concur that CT attempting to accomplish wanted outcomes by deduction objectively in an objective arranged manner [51]. CT skills prepare students in the 21st century to manage social, logical and useful issues later on [52].

### 3.2.2. Critical Thinking Indicator

In this section, the researcher summarizes the indicators of critical thinking skills from various literature. Can be seen in Table 4.

**Table 4.** Indicators of Critical thinking Skills

Fachione, 1990 [53]	Marzano, 2007 [33]	Ennis, 2011 [47]	Angelo, 1995 [17]	Halpern, 2015 [54]	Perkins & Murphy, 2006 [55]
Interpretation	Comparing	Elementary Clarification	Analysis	Verbal reasoning	Clarification
Analysis	Classifying	The Basic For Decision Inference	Synthesis	Analysis argument	Assessment
Evaluation	Inductive reasoning	Advances Clarification	Problem Recognition and problem solving	Skill in thinking as hypothesis testing	Inference
Inference	Analyzing errors	Supporting and Integration	Inference	Using likelihood and uncertainty	Strategies
Explanation	Constructing support		Evaluation	Decisions making and problem-solving skills	
Self Regulation	Analyzing perspective Abstracting Decisions making Investigation Problem- Solving Ekperimental Inquiry Invention				

### **3.3. Increasing Critical Thinking Skills**

Students, CT skills in the learning process can be developed with the following strategies: 1) preparing the subject matter well; 2) discuss the controversial subject matter; 3) raise problems that cause cognitive conflict; 4) assigning students to find varied views on a problem; 5) assigning students to write articles to be published in a journal; 6) analyzing articles from newspapers or other media to find new ideas; 7) provide problems to find different solutions; 8) provide a reading that is different from the tradition of students to be debated or discussed; and 9) inviting people with controversial views [36].

CT can be empowered through activities based on the concept the concept of CT. One learning model that can empower CT is Problem Based Learning (PBL). According to Margetson (1991), the characteristics of the PBL model can encourage open, reflective, critical, and active thinking; The problem solving used can stimulate the development of effective and efficient reasoning skills [56]. PBL also makes students act metacognitively and learning will be focused on solving problems so that students are trained to think critically [57]–[59]. Based on the research of Hmelo-Silver and Lin (2000) with PBL students are more likely to identify problems to answer students' hypotheses of integrating new information into problem-solving [60]. Several research results show that PBL can improve critical thinking [61]–[65].

## **4. Conclusion**

HOTS are how to improve the thinking skills of students at a higher level of thinking. HOTS deals with CT skills to receive HOTS deal with CT skills to receive different kinds of data, think creatively in tackling issues and can make decisions in complex situations. This literature review proves that HOTS involves the analysis of thought processes, evaluation, and creation to answer a problem. Through HOTS students can clearly distinguish ideas, be able to make hypotheses, argue well, be able to solve problems, can construct explanations well, can solve problems. Understanding complex things become clearer and more detailed. Ability CT skills are essential in the 21st century since it is one of the fundamental objective abilities of science educations. The CT skills controlled by understudies can assume a job in managing social, scientific, and practical problems effectively in the future. CT skills can be expanded by utilizing the Problem-based learning (PBL) model. Students think about how to solve the problems faced, in the problem-solving process there is a high-level thinking process, namely critical thinking. The PBL model has the potential to improve students' CT skills because the characteristics of the PBL model can encourage open, reflective, critical, and active thinking; the problem solving used in the PBL model can stimulate the development of effective and efficient thinking skills..

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