Teaching and Assessing Analytical Thinking

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Abstract

The focus of this paper is on the pivotal role of analytical thinking in student education, irrespective of the curriculum. Teaching analytical thinking is a vital instructional skill and a foundation of student learning. Instructors should be well-versed in teaching analytical thinking, as it forms the bedrock of critical thinking and problem-solving. Despite not being explicitly listed as one of the seven high-impact teaching practices in undergraduate education by Chickering & Gamson (1987), critical thinking and analytical thinking are frequently cited as Student Learning Outcomes in academic courses and programs in the United States (Grandinetti & Puncochar, 2019; Peñaloza & Puncochar, 2019; Puncochar, Barch, Albrecht, & Klett, 2018). University instructors often claim that they incorporate critical thinking into their teaching to improve student learning outcomes (Janssen et al., 2019).

In 2014, Oceans of Data outlined the specific skills and knowledge required to compete in a big-data-centered economy. Analytical thinking ranked highest in both knowledge AND skills. The results were validated by nearly 100 data analyst peers (see Krumhansl, 2016). Although analytical thinking ranked higher than critical thinking in both knowledge and skills, this paper posits that analytical thinking is a necessary precursor to critical thinking and problem-solving.

1. Differentiating Analytical Thinking and Critical Thinking

Definitions of analysis and critical thinking suggest that analytical thinking is not just foundational to critical thinking, but a necessary precursor. By definition, analysis is a detailed examination of the elements or structure of an issue. Critical thinking is objectively analyzing an issue to form a judgment. An objective analysis comes before a critical evaluation, so analytical thinking necessarily precedes critical thinking. This differentiation is crucial in understanding the hierarchy of thinking skills. Skills for analytical thinking and critical thinking differ (Anderson & Krathwohl, 2001; Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956),

although the terms have recently merged as critical-analytical thinking (Brown, Afflerbach, & Croninger, 2014). Occasionally, "problem solving" is included in critical-analytical thinking (Johnson, 2017). A deeper analysis of these terms leads to a refinement in which analytical thinking is the basis for critical thinking and problem-solving (see Figure 1).

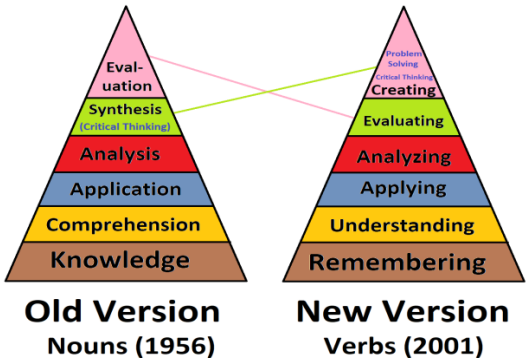

Fig.1. Blooms Taxonomy

Figure 1. Bloom's Taxonomy (1956) describes a hierarchical model to classify educational learning objectives into levels of increasing cognitive complexity. The New Bloom's Taxonomy (2001) uses verbs instead of nouns and places "Creating" above Evaluating. "Critical Thinking" and "Problem Solving" are placed above Analysis and Analyzing in both the Old and New Versions of Bloom's Taxonomy.

2. Teaching Analytical Thinking

Examples of how to teach analytical thinking to students – sometimes referred to as how to teach students to think critically – usually start with presenting a problem, question, or text for "analysis," followed by a detailed description of the student's understanding. University instructors who aim to develop students' analytical thinking skills tend to use three primary teaching strategies:

1. Allow their students sufficient "wait time", approximately three seconds (see Rowe, 1974, 1978).
2. Provide students with considerable practice in analytical thinking.
3. Give students a framework to assess analytical thinking.

Instructors typically determine assessment measures of analytical thinking, which often rely on end-of-course examinations or standardized tests to show students' acquired proficiencies. For example, science instructors might use a lab or capstone assignment to collect student assessment data related to analytical thinking, and mathematics instructors might use final exam questions. When students do *not* meet proficiency or advanced rates expected on analytical thinking measures, actions taken usually include changes to the examinations, curriculum, or student support services, rather than changes to instructional strategies. This paper posits that changes to instructional strategies are most likely to improve students' analytical thinking. Recommended changes include revising rubrics, increasing wait time, and incorporating more student practice with analytical thinking.

In *Islam, Culture, and Education: Essays on Contemporary Indonesia* (2014), Professor A. Chaedar Alwasilah discusses how improved rationality would lead to a profound liberation of thinking in students, enabling them to become constructive, contributing Indonesian citizens throughout their lives. He emphasizes the importance of enhancing critical thinking by encouraging students to engage in their national political culture and public discourse. This type of critical thinking depends on the honed skill of analytical thinking.

Helping students hone their analytical thinking skills can occur across disciplines. For example, Faust (1989) provides foundational observations regarding analytical thinking in mathematics and computer science. Puncochar (2025) outlines three instructional strategies to enhance students' analytical thinking in language education, namely, peer review, reducing the use of pronouns

in writing, and providing frequent instructor feedback.

Rubrics used to assess analytical thinking sometimes include criteria unrelated to analytical thinking (e.g., applying, communicating, evaluating, and integrating information; see Azid, Maksin, Mohktar, & Hashim, 2015). Rubrics with an exclusive focus on analytical thinking would include skills such as systematically examining evidence, identifying patterns, making logical inferences from the evidence, and recognizing the limitations of conclusions. Unfortunately, the use of rubrics to assess formative gains and provide feedback to diagnose students' strengths and weaknesses in analytical thinking remains infrequent (Brown, Afflerbach, & Croninger, 2014, p. 559).

3. Conclusion

Three simple instructional changes can help students sharpen their analytical thinking skills. Instructors should allow students *at least* three full seconds to think before moving on or asking someone else to respond. Lectures should include time for students to practice analytical thinking responses in small groups before reporting to the whole class. Instructors should use rubrics with an exclusive focus on analytical thinking when assessing student learning.

Teaching and assessing analytical thinking in the classroom can increase the likelihood that students will apply this skill to examine the influences on their personal, professional, and civic lives.

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