



Indicator: All teachers teach methods of logic, synthesis, evaluation, and divergent thinking. (5100)

Explanation: Higher-order and critical thinking, such as logic, synthesis, evaluation and divergent thinking, are purposeful, reasoned, and goal-directed. These skills are necessary for students to apply knowledge in novel situations, evaluate the use of their time and effort, and become productive members of society. Higher-order thinking skills are complex, and the components of higher-order thinking skills must be taught explicitly. Providing opportunities for students to generalize these skills more broadly should vary, depending on students' competency.

Questions: What are higher-order and critical thinking skills? Why are they important? What are the best ways of teaching higher-order and critical thinking skills?

What are higher-order and critical thinking skills and why are they important?

Higher-order and critical thinking are purposeful, reasoned, and goal-directed. Critical thinkers do so without prompting, and usually with conscious intent, in a variety of settings. When people think critically, they are evaluating the outcomes of their thought processes - how good a decision is or how well a problem is solved (Halpern, 1996, 1998).

Higher order and critical thinking skills are those activities that go beyond the stage of understanding and lower-level thinking, such as memorization and recall of information, to more complex skills, such as analyzing, synthesizing, and evaluating (Bloom, 1956). Higher order and critical thinking can be conceptualized as a non-algorithmic, complex mode of thinking that often generates multiple solutions (Resnick, 1987). Such thinking may include uncertainty, application of multiple criteria, reflection, and self-regulation. Learning experiences that contribute to the development of higher order and critical thinking skills focus on analysis, evaluation, and synthesis and develop problem solving, as well as inference, estimation, prediction, generalization and creative thinking skills (Wilks, 1995). Additional examples of higher-order and critical thinking skills include: question posing, decision-making, and systemic thinking (Dillon, 2002; Zohar & Dori, 2003; Zoller, Dori, & Lubezky, 2002).

Developing higher-order skills is important because they facilitate the transition of students' knowledge and skills into responsible behavior in society (Ben-Chaim, Ron, & Zoller, 2000; Zoller, 1993, 1999, 2001). Perkins and Unger (1999) suggest, "Understanding a topic is a matter of being able to think and act creatively and competently with what one knows about the topic. ... The ability to perform in a flexible, thought-demanding way is a constant requirement" (p. 97).

Halpern (1998) further argues that the information explosion is yet another reason why specific instruction in thinking needs to be provided. The wealth of information available from the internet can be overwhelming, especially for young people who are still in the early stages of interpreting, digesting, and evaluating disparate pieces of information. Further, she suggests that the dual abilities of knowing how to learn and knowing how to think critically about



information are important 21st century skills. Zoller (1999) asserts that because education is our principal means of preparing students to be responsible citizens in society, schools, at all levels, should assume responsibility for teaching higher order thinking skills.

What are the best ways of teaching higher-order and critical thinking skills?

Students can become better thinkers as a result of appropriate instruction. Halpern (1998) has proposed a four-part model for teaching higher-order, critical thinking. Those four parts include:

- 1) Students are taught to recognize when a higher-order skill is needed: Good instructional programs help learners decide when to make the necessary effort in critical thinking and when a problem or argument is not worth that effort. Students must be taught how to evaluate problems in terms of what situational problem-solving strategies they would use, estimate the amount of time and effort required to execute that strategy and then determine whether or not to move forward.
- 2) Students are taught explicit problem-solving skills: Critical-thinking instruction is predicated on two assumptions: a) Students can be taught to define and identify thinking skills; and b) Students will be more effective problem-solvers if they apply these thinking skills. Defining and identifying the thinking skills must be taught explicitly.
- 3) Training is structured to support students' transfer of skills: The necessity of explicitly teaching students to apply the thinking skills that they've learned to identify varies by student and by skill. Some students will more easily generalize the skills to novel problems than others; some will need more directed practice with multiple exemplars before generalizing the skills independently. Those exemplars may be arranged so that their characteristics vary systematically, allowing the learner to gradually improve and for teachers to monitor closely the specific characteristics of problems that are more challenging for learners.
- 4) Students are taught to self-monitor their problem-solving effectiveness: During problem-solving and critical thinking, students should monitor their performance, checking whether progress is being made toward an appropriate goal, ensuring accuracy, and

making decisions about the use of time and effort. This monitoring should produce a permanent product, such as a graph, a checklist, a table or notes, that is publically visible and that a teacher can examine. Based on that examination, the teacher should give feedback to the student about the process being followed and the veracity of the recorded progress toward the solution. This gives the teacher the opportunity to reinforce good problem-solving on the part of the student and, if necessary, provide corrective measures, such as questioning or modeling, if the student's efforts are off course.

References and resources

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