The Role of Critical Thinking in Students' Acquisition of Foundational and Factual Knowledge

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The purpose of this article is to argue that critical thinking concepts and strategies should not be absent from students' acquisition of factual knowledge and basic skills. Self-reflection, Intellectual Standards, and the Elements of Reasoning, as detailed in Richard Paul and Linda Elder's model for critical thinking (2001), should be applied to even the most basic levels of knowledge. The metacognitive aspects of the model are necessary for learning foundational material as well as for developing deep understanding of advanced concepts.

It is often suggested that students, especially students enrolled in introductory courses within a curriculum program, need the basics (e.g., factual information or rote procedures) as a foundation for the critical thinking reserved for upper-level courses. Others have expressed concerns that if critical thinking is integrated into teaching, then course content may be sacrificed. From this perspective, critical thinking is viewed as an add-on to instruction rather than a means for thinking about all course-related content. It is implied within this view that factual knowledge can be adequately learned for subsequent recall and application without students' engaging in aspects of critical thinking as they construct knowledge.

Rote Memorization vs. Conceptual Understanding

Proponents of critical thinking do not impugn the value of learning factual content. Indeed, thinking critically relies on a store of relevant knowledge about the issue at hand, and advocates for critical thinking do not promote asking students to form opinions or solve problems without having to know anything *a priori*. However, the quality of students' understanding of factual information depends on how the new knowledge is constructed. It is hard to imagine any educator wanting students to learn factual information through rote memorization without understanding the meaning of what is learned. Can we think of any situation in which the goal is to memorize without full attention or comprehension?

Similarly, the belief that students' attainment of foundational skills and factual knowledge occurs without active engagement in critical thinking assumes that retention and transfer of knowledge for advanced problem solving is facilitated through rote or transmission models of learning. In essence, retention requires that students remember what they have learned, whereas transfer requires students not only to remember but also to gain a conceptual understanding of and be able to use what they have learned. Rote learning may consist of relevant knowledge, but it is limited in its use for problem solving and for transfer to new situations. Moreover, when faculty focus too heavily on rote learning at the expense of conceptual understanding, students' ability to apply material for practical or intellectual purposes is limited.

Researchers have often described the effect of traditional teaching practices that emphasize rote learning rather than conceptual understanding and critical thinking. For

example, Donald Blais (1988) stated that traditional teaching in mathematics that involves giving students a maximum of explanation implies the creation of a listener-follower role for students. Such a role, he conjectures, contributes to dependence, fosters the growth of learned helplessness, and encourages students to memorize information instead of constructing robust knowledge structures. Blais contended that traditional mathematics courses focus too much on transmitting content at the expense of thought processes. He felt that the focus should be on the development of thinking skills and conceptual understanding.

The Role of Metacognition

The essence of Paul and Elder's model for critical thinking is metacognition: applying intellectual tools to assess and monitor thinking in order to make thinking better—more clear, more accurate, more defensible. Current literature in mathematics and science education supports an emphasis on metacognition for all levels of instruction—arithmetic through calculus and beyond. Metacognition focuses on methodology which develops students' metacognitive skills, meaning one's own knowledge concerning one's own thoughts. In particular, research on the role of metacognition in problem solving has been concerned with two related components: (a) knowledge of one's own thought processes and (b) regulation and monitoring of one's activity during problem solving. Alan Schoenfeld (1987) asserted that good problem solving calls for using effectively what you know: "If you don't have a good sense of what you know, you may find it difficult to be an efficient problem solver" (p. 190).

Elements of Reasoning and Intellectual Standards

To further explore the relevance of critical thinking to the acquisition of factual or foundational knowledge, consider the effects of *excluding* aspects of Paul and Elder's Elements of Reasoning and Intellectual Standards from the teaching/learning process. First, consider a learning environment where one (or more) of the Elements of Reasoning is not accessible for students' learning. In this event, students learn content without understanding (1) the purpose of this information within a conceptual framework, (2) how the information is used in an attempt to figure something out, (3) how the information could be used to support or challenge students' assumptions or points of view, (4) how the information shapes concepts, etc. Hence, factual knowledge without the Elements of Reasoning becomes irrelevant and disconnected to concepts at hand and detached from its value or practical use. Without the Elements, facts are not integrated within the larger conceptual framework to which they relate.

Elements of Reasoning

- All reasoning has a purpose.
- All reasoning is an attempt to figure something out, to settle some question, to solve some problem.
- All reasoning is based on assumptions.
- All reasoning is done from some point of view.
- All reasoning is based on data, information, and evidence.
- All reasoning is expressed through, and shaped by, concepts and ideas.
- All reasoning contains inferences by which we draw conclusions and give meaning to data.
- All reasoning leads somewhere, has implications and consequences.

Paul and Elder's Intellectual Standards are defined as universal intellectual standards which are applied to thinking whenever one is interested in checking the quality of reasoning about a problem, issue, or situation. To help students learn course content, Paul and Elder suggest that instructors should pose questions which probe student thinking, hold students accountable for their thinking, and, through consistent use by instructors in the classroom, become internalized by students as questions they need to ask themselves. Paul and Elder assert that these questions need to become ingrained in students' inner voices, guiding them to better thinking. As in the previous example, the exclusion of one or more standards suggests that students learn content but are not held accountable for knowing and communicating the content clearly, accurately, precisely, with relevance, in depth, or with logic. Hence, excluding intellectual standards from learning suggests the occurrence of rote/superficial learning and teaching. Moreover, having students inculcate the standards into their thinking provides them with the metacognitive tools suggested by Schoenfeld as necessary for effective problem solving.

Intellectual Standards

- Clarity
- Accuracy
- Precision
- Relevance
- Depth
- Breadth
- Logic

In summary, critical thinking gives students a set of intellectual tools associated with metacognition and self-monitoring appropriate to any particular mode or domain of thinking. Though students think, they ordinarily do not think in ways that lead to self-assessment and reflection. Applying critical thinking concepts to foundational and factual knowledge is necessary for promoting our students' conceptual understanding of course content.

References

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