Critical Thinking: Domain Specific Applications, A Review of Literature

James H. Hess II

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Critical Thinking is routinely discussed as a way to improve one’s ability to think more objectively and holistically. While this is indeed a worthwhile goal, it should be noted that critical thinking does not have a definitive definition. Therefore, it is difficult to truly identify what aspects of critical thinking one should utilize in order to improve thinking skills. There are a few schools of thought, but one of the most useful comes from Dr. Richard Facione. He led a group of experts in order to define what critical thinking is, the definition provided:

“We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one’s personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society” (Facione, 2007, p. 22).

Facione also further identified the cognitive skills that are necessary for critical thinkers. Those skills along with a review of relevant works that evaluated these skills are the subject of this review of literature.
**Critical Thinking Skills**

Interpretation is defined as the ability, “…to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria” (Facione, 2010, p. 5).

The skill analysis is defined as the ability, “…to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions” (Facione, 2010, p. 5).

Evaluation as a critical thinking skill is defined as the ability, “…to assess the credibility of statements or other representations which are accounts or descriptions of a person’s perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation” (Facione, 2010, p. 5).

Inference is, “…to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to deduce the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation” (Facione, 2010, p. 6).

Explanation is, “…being able to present in a cogent and coherent way the results of one’s reasoning. This means to be able to give someone a full look at the big picture: both ‘to state and to justify that reasoning in terms of evidential, conceptual, methodological, criteriological, and contextual considerations upon which one’s results were based; and to present one’s reasoning in the form of cogent arguments’” (Facione, 2010, p. 6).
Lastly, Self-Regulation is to, “…self-consciously monitor one’s cognitive activities, the elements used in those activities, and the resulted educed, particularly by applying skills in analysis, and evaluation to one’s own inferential judgments with a view toward questioning, confirming, validating, or correcting either one’s reasoning or one’s results” (Facione, 2010, p. 7). As aforementioned in the discussion of each critical thinking skill, self-regulation may be applied with each skill throughout the critical thinking process. By doing so, the information gleaned by each skill is questioned, confirmed and validated. Self-regulation is the step in which the student needs to ensure that various personal biases are removed as much as possible. Being aware of one’s biases is paramount to ensuring its presence is reduced.

**Summary of Research Findings/Results for Critical Thinking**

Critical thinking is a widely-used term with a very ambiguous meaning. However, some researchers have thoroughly studied critical thinking and developed some useable definitions. While it would be too laborious to discuss the various definitions, one researcher, Peter Facione (2010), developed a set of cognitive skills that can be applied to teaching, utilizing, and assessing critical thinking skills. These cognitive skills are interpretation, analysis, evaluation, inference, explanation, and self-regulation; defined previously in this chapter. Based on these cognitive skills, these reviews will focus on effective teaching of critical thinking, domain-specific application of critical thinking, and applying critical thinking to intelligence analysis.

Overall, teaching critical thinking in a deliberate and structured manner has produced tremendous results in the critical thinking abilities of students. However, teaching critical thinking in a domain-specific manner has a greater impact on students’ ability to apply critical thinking skills (McKown, 1997). And lastly, critical thinking taught using problem-solving, hands-on exercises or asynchronous group projects typically produces the best critical thinkers.
Learning Critical Thinking

Effective ways of teaching critical thinking is extremely important. By teaching critical thinking effectively, a deliberate methodology that incorporates tangible outcomes can be employed. Teaching critical thinking in a theoretical and non-contextual manner will probably never truly demonstrate effective outcomes. Friedel, Irani, Rudd, Gallo, Eckhardt, and Ricketts (2008) studied the outcomes of students that were taught critical thinking skills overtly. This study demonstrated that those students that were taught critical thinking overtly demonstrated significantly higher levels of critical thinking.

Mazer, Hunt, and Kuznekoff (2007) conducted a study in a basic communications course that demonstrated critical thinking may be fostered through student interaction. This study also found that an effective strategy was for the instructor to teach critical thinking strategies, and then let the students engage in interactive learning approaches that enabled the students to become a part of their own education. Schamber and Mahoney (2006) conducted a similar study in which students were taught to cultivate critical thinking skills through collaborative groups. They also found that group work enhanced critical thinking skills, and provided opportunities for students to assess their thought processes and ideas.

While it might seem that for interactive instruction or asynchronous learning to promote critical thinking that it needs to be conducted in small or manageable size classrooms, Yang (2007) conducted a study to determine if critical thinking skills could still be cultivated in large classrooms or online. He found that indeed critical thinking skills can be taught in large classrooms, and specifically that asynchronous learning is a vehicle that supports that approach. Also, well-developed Socratic dialogues have been demonstrated as a tool that promotes critical thinking skills. An additional note here, Astleitner (2002) conducted a study to determine the
effectiveness of teaching critical thinking skills online. He found that there was no difference in critical thinking outcomes from either a traditional or online instruction.

The environment also provides a valuable asset to be considered when teaching critical thinking. A study conducted by Nelson Laird (2005) identified that students that are exposed to diversity and other various interactions demonstrate greater propensity toward critical thinking. Those students typically are found to be more open-minded, and therefore willing to exhibit greater flexibility when solving problems or understanding larger aspects of complex skills. Ernst and Monroe (2006) conducted a similar study on how the environment affects critical thinking skills and dispositions, and they arrived at a similar conclusion. Environments play an integral part of education, and indeed critical thinking skills can be cultivated through the use of incorporating the environment and aspects of it in instruction.

Teaching critical thinking through an understanding of student dispositions and the types of forums that need to be incorporated and leveraged. Stedman and Andenoro (2007) found that by engaging students through critical thinking focused exercises helps develop critical thinking dispositions. Furthermore, a certain maturity and deeper understanding of course material may be accessed through developing critical thinking dispositions. Yang, Newby, and Bill (2005) found a similar growth in critical thinking skills through the use of Socratic questioning in instruction. They found the Socratic-based instruction to be especially beneficial through the use of asynchronous forums. Also, Duphorne and Gunawardena (2005) conducted a study on the effects of utilizing computer designs and organizers on critical thinking skills. They found that there was no significant difference of participants that utilized the organizers compared to those that did not. They evaluated three different computer models that would assist in organizing data and problem sets, and found that none of them increased the critical thinking abilities of participants.
There is research that suggests there is a relationship between critical thinking skills and critical thinking disposition. Facione and Facione (1997) conducted a five-year longitudinal study examining this relationship, and they found a low positive correlation between this relationship of critical thinking skills and critical thinking disposition among different populations. However, as Friedel, Irani, Rudd, Gallo, and Eckhardt point out, given that Facione and Facione incorporated a large sample size significant correlations should be expected (2008). Finally, it should be noted that effective critical thinking instruction motivates as well as incorporates critical thinking skills and dispositions (Facione, 1998).

**Teaching Critical Thinking**

I think that when it comes to teaching critical thinking, we need to examine the abilities of teachers and how well they understand critical thinking. Teachers should understand what critical thinking is, and how they can best teach it. Also, they need to be able to recognize critical thinking, especially since the ultimate goal of teaching critical thinking should be in seeing it applied or infused within student outcomes.

Genc (2008) conducted a study looking at critical thinking dispositions between male and female teacher candidates. What he found was that females demonstrated a higher aptitude toward critical thinking, while their male counterparts demonstrated a greater capability toward analytical thinking. I do need to point out that there is still debate whether females are better critical thinkers (Friedel, et al, 2008), but it is an issue worth consideration. Since intelligence analysts, in the U.S. Army as well, can be either male or female, I think this study may provide some valuable insights to strategies toward training critical thinking skills through heterogeneous analytical teams. Genc also argues that programs need to focus or continue to improve on teaching critical thinking in education programs, and focus more on specific aspects of critical
thinking. Innabi and El Sheikh (2006) conducted a similar study targeting mathematics teachers in Jordan. They found that most teachers believed that they have taught critical thinking, but could not demonstrate an understanding of what it was.

Grosser and Lombard (2008) conducted a study on the development of critical thinking abilities and teachers. They found that newer teachers teach critical thinking skills around the 12th grade level. However, by incorporating strategies in how to teach critical thinking, especially courses that are taught critical thinking in a domain-specific method, would prepare teachers to more effectively teach critical thinking.

It has been alluded to that teaching effective critical thinking can best be accomplished through domain-specific application. Grauerholz and Bouma-Holtrop (2003) conducted a study that taught a Sociology course with critical thinking applied domain-specifically. They found that students had a deeper understanding of the context of the instruction, and aptly demonstrated critical thinking skills. Conversely, Solon (2007) conducted a study that generically applied critical thinking to an introductory Psychology course. He found that there was no statistical difference in the psychology tests taken by the students; however, there was an increase in the critical thinking test scores that were taken by the students. Davies (2006) looked at domain-specific applications of teaching critical thinking, as well as critical thinking as a stand-alone instruction and did not find any difference between them. Davies research, similar to Solon (2007), found that critical thinking skills are generic and not domain-specific in nature.

However, a very comprehensive study conducted by Donald Hatcher (2006) found that there was a significant difference in critical thinking skills when critical thinking is tailored to a domain-specific application. He found that the groups that learned critical thinking as a stand-alone course did not score as well, and lacked clarity in their usage of critical thinking skills. He
found that teaching critical thinking skills and then applying them through practice proves that domain-specific applications of critical thinking produce far greater results.

As to examining critical thinking and its applicability to intelligence analysis, there are several studies that have looked at critical thinking and its effect on problem solving. Since intelligence analysis is steeped in the concept of solving problems, this is a comparable evaluation for the purposes of applying critical thinking to intelligence analysis.

Colucciello (1997) conducted a very thorough study of nursing students and their dispositions toward critical thinking skills. She utilized Facione’s (1990) initial Delphi Study, which resulted in the development of the aforementioned critical thinking framework, to develop her framework of skills to be tested. She found that through a domain-specific application of these skills, students’ critical thinking skills could be assessed individually and more thoroughly. She found that critical thinking skills did indeed improve through a domain-specific application of instruction oriented toward this framework. In her conclusion, she was able to focus on specific ways in which they could develop strategies to improve on areas that were deficient.

Sungar and Tekkaya (2006) also conducted research on problem-based learning and its application to critical thinking. They found that students were able to perform at high order thinking levels, were more collaborative in learning, and that their critical thinking skills benefitted from the problem-based learning approach. While this was not a study conducted specifically to evaluate domain-specific application of critical thinking, it does validate the theory that critical thinking skills can benefit greatly from problem-based applications.

A study authored by my advisor that will be published in an upcoming issue of *Journal of Agricultural Education*, Dr. Friedel (in press), was conducted to determine if a specific problem solving method increased the critical thinking dispositions of students. What he found was that
there was no specific method that directly related to an increase in critical thinking abilities; however, critical thinking dispositions benefited from problem solving instruction. Also, he found that students that went through this study were more adept to using various problem solving methodologies and styles in order to come to a solution. This in itself can significantly apply to critical thinking, and warrants further examination.

The final study was specific to U.S. Army Officers and how critical thinking instruction has been employed successfully. Schumm, Webb, Turek, Jones, and Ballard (2006) conducted a study at the U.S. Army’s Command and General Staff College on the successful usage of critical thinking skills and reasoning. They found that students benefited from collaborative exercises, student diversity, and domain-specific application of critical thinking skills. They also found that students performed better when instructors were prepared and delivered the context of the class by utilizing the aforementioned instructional strategies. Therefore, Socratic-questioning, diversity of students, problem-solving methods, and domain-specific applications of critical thinking directly impacted these officers’ ability to utilize and apply critical thinking skills.

**Summary of Critical Thinking Research**

The aforementioned studies overwhelming highlight the value of utilizing critical thinking in instruction. Students benefit in the areas of providing more objective and thorough solutions or answers. Also, students have been found to benefit from domain-specific applications of critical thinking and problem-based applications.

Next, the environment needs to be conducive to effectively learn critical thinking. This means that classes need to be structured with diversity in students, exercises that are specific to the instruction, and using the relevant tools that are available to them.
Instructors need to be well versed in critical thinking. If students are to learn and effectively apply critical thinking skills, then the instructors need to not only understand critical thinking, but be able to cultivate classrooms and environments that help promote the usage of critical thinking skills and be able to effectively evaluate its usage.

Critical thinking also needs to be taught in a domain-specific setting. While some studies do not specifically agree that domain-specific application of critical thinking benefit the further development of critical thinking skills compared to teaching critical thinking as a stand-alone course, it does appear in the studies that applied critical thinking as a framework to be applied domain-specifically that those students not only benefited, but the instructor could develop strategies to improve shortcomings. This benefit is definitely worth the effort of developing domain-specific applications of critical thinking, because student feedback and improvement is one impetus of critical thinking.

**Annotated Resources/Selected Works**


This study looked at the differences between teaching critical thinking skills online versus a traditional classroom setting. The results demonstrate that the mode of instruction did not impact the development of critical thinking skills, rather the abilities of the instructor was the single most important factor. Also important are the exercises incorporated into the instruction and the focus of instruction utilizing critical thinking teaching techniques.


This study utilized Facione’s critical thinking cognitive skills in order to evaluate nursing students’ dispositions toward critical thinking. She found that indeed the cognitive skills are relevant to the development of critical thinking abilities, and further identified that each person develops them differently and these differences need to be fostered in order to refine those skills.


Davies’ study was focused on critical thinking skills in terms of generic development. He found that one can develop critical thinking skills without focusing on domain-specific development.
This demonstrates that critical thinking skills are more cognitively developed and not tied to any specific subject or in need of being tailored to a specific domain.


Perhaps the authority on what critical thinking is, Dr. Facione has conducted countless studies over the past twenty years attempting to define and provide insight to what constitutes sound cognitive skills that can be attributed to critical thinking. The cognitive skills that Facione has identified are, interpretation, analysis, evaluation, inference, explanation, and self-regulation.


This study demonstrates the value of utilizing collaborative exercises as part of a curriculum. Student critical thinking skills are fostered through good instruction, prepared instructors, and challenging assignments that are tailored to the subject matter.
References and Additional Resources


