

Chapter 7: Measuring Critical Thinking Skills

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Do critical thinking skills exist -- and can they be measured? Clearly articulating the construct of critical thinking is central to measurement yet articulating a clear definition of critical thinking remains elusive. In fact, Halpern (1999) acknowledged the difficulty of defining the construct and she offered a wide range of possible interrelated definitions. She also reflected on similarities of the construct across disciplines including: problem solving, decision making, and cognitive processes (also see Halpern, 1996 for a comprehensive review of the construct of critical thinking). Despite the complexity of defining the construct, we believe that it is both possible and important to measure critical thinking, particularly during this era of increased demand for accountability.

Critical thinking remains one of the most important skills identified as an outcome of a college degree. Not only are critical thinking skills desired in college graduates, but this skill set is beneficial to an educated citizenry. In addition to students, many constituencies have a keen interest in college graduates demonstrating critical thinking skills, including educators (Appleby, 2009; Keeling & Hersh, 2012; Yanchar, Slife, & Warne, 2008), higher education associations (American Association of Colleges & Universities [AAC&U], 2006; 2010), employers (AAC&U, 2008), and the general public (AAC&U, 2005; Baum & Ma, 2007). More recently, the American Psychological Association (APA) reaffirmed the importance of critical thinking skills in the revision of discipline specific guidelines for the undergraduate major (APA, 2013).

More generally, this emphasis on critical thinking as an important outcome of a college degree was emphasized with the publication of *Academically Adrift* by Arum and Roksa (2011a). In their research using the Collegiate Learning Assessment (CLA), they found that a large percentage of students in both two-year and four-year institutions did not demonstrate progress in critical thinking skills at the end of their academic studies. Although the efforts of Arum and Roksa (2011b) have limitations with regard to methodology and the motivation of CLA test-takers, the value of the process is clear; meaningful assessment can provide invaluable feedback to educators, administrators, and to the higher education community.

Broad Perspectives About Critical Thinking

Scholars have written extensively about critical thinking (Halpern, 1996; Halpern, 2010) as an important skill; however, a comprehensive review and analysis of the construct exceed the scope of this chapter. Some have suggested that critical thinking is developed as a discipline specific skill (Davies, 2013; McGovern, Furumoto, Halpern, Kimble, McKeachie, 1991), whereas others have suggested that critical thinking is developed broadly across many courses. Critical thinking can be described as the act of processing, evaluating, and creating new information rather than merely recalling information (Butler, 2012; Halpern, 2010). In fact, Dunn and Smith (2008) made the argument that writing is a form of critical thinking (see also Preiss, Castillo, Flotts, & San Martin, 2013) and Halpern (1987) suggested that the generation and

interpretation of analogies is an activity that clearly demonstrates critical thinking. See Table 1 for additional definitions of critical thinking definitions.

Table 1

Examples of Critical Thinking Definitions

“The conscious process a person does when he or she explores a situation or a problem from different perspectives” (French, Hand, Nam, Yen, & Vazquez, 2014, p. 275).

“Challenging a claim or an opinion (either one’s own or another person’s) with the purpose of finding out what to believe or do” (O’Hare & McGuinness, 2009, p. 123).

“Reasonable and reflective thinking that is focused on deciding what to believe to do” (Norris & Ennis, 1989, p. 1).

“The use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal-directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task” (Halpern, 2003, p. 6, as cited in Butler, 2012).

A second term—psychological literacy—has also been used interchangeably with historical origins dating to the St. Mary’s conference in 1991 (McGovern, Furumoto, Halpern, Kimble, McKeachie, 1991). With the re-emergence of psychological literacy (McGovern et al., 2010) emphasized as an important outcome for the major, critical thinking continues to be a central topic in the discussions of psychology educators. In fact, many components of critical thinking are contained in the definition of psychological literacy:

(a) having a well-defined vocabulary and basic knowledge of the critical subject matter of psychology; (b) valuing the intellectual challenges required to use scientific thinking and the disciplined analysis of information to evaluate alternative courses of action; (c) taking a creative and amiable skeptic approach to problem solving; (d) applying psychological principles to personal, social, and organizational issues in work, relationships, and the broader community; (e) acting ethically; (f) being competent in using and evaluating information and technology; (g) communicating effectively in different modes and with many different audiences; (h) recognizing, understanding, and fostering respect for diversity; and (i) being insightful and reflective about one’s own and others’ behavior and mental processes. (McGovern, et al., 2010, p. 11)

This conceptualization dovetails nicely with recent national efforts devoted to validating undergraduate education in psychology as a liberal arts degree that affords students opportunities to think critically across multiple career opportunities.

The American Psychological Association revised the *APA Guidelines for the Undergraduate Psychology Major* in 2013, referred to as Guidelines 2.0, which continued to emphasize

complex thinking as an important outcome of the major in psychology. In fact, Goal 2 of the Guidelines includes five specific student outcomes:

- use scientific reasoning to interpret psychological phenomena
- demonstrate psychology information literacy
- engage in innovative and integrative thinking and problem solving
- interpret, design, and conduct basic psychological research
- incorporate sociocultural factors in scientific inquiry

If we compare these outcomes to the definitions of critical thinking above, it seems apparent that there is overlap between the definitions of psychological literacy and critical thinking.

Measures of Critical Thinking

Our review of critical thinking measures is twofold: First, we want to make sure that the mainstream measures of critical thinking are reviewed (albeit briefly) in this chapter. We review critical thinking measures that are specific to psychology as well as broad-based general measures. Second, our review is not to be interpreted as comprehensive. Instead we want to share information about the most common measures of critical thinking. If the reader desires additional details about the measures, we have included an appendix with references for additional information.

General Measures

For each of the general measures, we provide “quick snippets” about how the measure has been used in published research; this is meant to provide a sampling of the current efforts and is not meant to be comprehensive. For example, the Watson-Glaser Critical Thinking Appraisal test is often cited as one of the most frequently used general measures of critical thinking. More recently Burke, Sears, Kraus, and Roberts-Cady (2014) used the *Watson-Glaser Critical Thinking Appraisal* (WGCTA; Watson & Glaser, 1980) in a between-groups comparison of critical thinking scores across different disciplines. They found that students in a philosophy course improved their critical thinking when measured by the WGCTA. However, this same improvement was not found in the psychology course specifically designed to improve critical thinking skills. These findings may be a reflection of differences in courses, or quite possibly the difficulty in generally measuring the construct of critical thinking.

Macpherson and Owen (2010) also used the WGCTA in a test-retest study to examine development of critical thinking between two cohorts. They experienced difficulty in using the test to detect differences in critical thinking that were not already explained with the subtests of the WGCTA. These findings may reflect the complicated nature of the construct. Further, when Magno (2010) examined the role of metacognition in critical thinking, he used a structural equation model to link metacognition to the WGCTA. The construct is further complicated by findings from Clifford, Boufal, and Kurtz (2004). Using the WGCTA, they found that critical thinking skills were related to personality characteristics, in particular to openness to experience. Thus the construct of critical thinking, and the general measures of critical thinking, make it difficult to accurately measure the important skill.

Similar difficulties in accurately measuring critical thinking are present across other measures. For example, the *Cornell Critical Thinking Test* (CCTT) has been used in a variety of research studies. Recently, Stark (2012) compared the CCTT to a psychology specific test of critical thinking and found increases in the psychology specific test, but that these increases were not reflected in the more general measure using the CCCT. O'Hare and McGuiness (2009) administered a subset of tests from the *California Critical Thinking Skills Test* (CCTST) (Facione, Facione, Blohm, Howard, & Giancarlo, 1998) and *Raven's Advanced Progressive Matrices* (Set 1; Raven, 1965) to psychology undergraduates at Queen's University in Belfast. Using these measures, they found that reasoning skills improved as students progressed from the first to third year in college. The CCTST was also utilized by Feroand colleagues (2010) in a comparison of a small number of nursing students' critical thinking levels to performance on simulated clinical situations in nursing. However, they did not find a correlation between critical skills-based performance and performance on the CCTST. For a more overarching perspective about the challenges facing researchers using the WGCTA and the CCTST, see Schraw and Gutierrez (2012).

The *Halpern Critical Thinking Assessment* (HCTA; Halpern, 2010) is unique in that it relies both on recognition memory (such as completing multiple choice items) as well as recall memory (providing answers to short essays). Another important contribution that researchers have made with the HCTA is that these critical thinking scores have been compared with real-world outcomes, such as a significant negative correlation between HCTA scores and negative life events (Butler, 2012; Butler et al., 2012).

The *Ennis-Weir Test of Critical Thinking* (EWTCT; Ennis & Weir, 1985) is a free-response instrument which requires a written argument in response to a stimulus. The EWTCT was used by Szabo and Schwartz (2011) to examine potential pre-semester to post-semester growth in critical thinking scores using online discussion tools in a face-to-face course. Using this instrument, they concluded that the online supplemental instruction improved the critical reasoning of the pre-service teachers participating in the study.

Pascarella and colleagues (2014) assessed critical thinking in college students using the *Critical Thinking Test* (CTT; American College Testing Program, 1990) to examine how diversity experiences may affect critical thinking at the conclusion of the college experience. They conclude that exposure to diversity increases critical thinking in the students who participated in the study.

Psychology-Specific Measures

The *Psychological Critical Thinking Exam* (PCTE) developed by Lawson (1999) was utilized by McLean and Miller (2010) as a between groups measure to demonstrate critical thinking differences between courses. This measure also proved useful for Haw (2011) when he administered the PCTE to students in their second and fourth years of instruction to compare advances in critical thinking. Using the PCTE, he concluded that psychology-specific critical thinking skills do improve with additional instruction. Lawson, Jordan-Fleming, and Bodle (2015)

recently published an update to the PCTE. Similarly, Muehlenkamp, Weiss, and Hansen (2015) tested the efficacy of problem-based learning instructional techniques, and used scores on the PCTE as pre- and post-outcome measures, demonstrating that students in the problem-based learning condition exhibited higher critical thinking scores at the end of the semester.

A second psychology specific critical thinking test has also been used in a number of studies. *The Critical Thinking in Psychology Test*, developed by Bensley and Baxter (2006), contains an argument analysis test, a methodological reasoning test, and a causal reasoning test; however, this test is unpublished and is not widely available. It has, however, been used in multiple research contexts, such as an instrument used to measure gains after specific critical thinking instruction (Bensley, Crowe, Bernhardt, Buckner, & Allman, 2010) in specific research studies.

Teaching Critical Thinking Skills

Despite the difficulties with defining the construct and measuring critical thinking, researchers continue to recommend teaching these skills. More specifically, several researchers (Frantz & McCarthy, in press; Lilienfeld, Lohr, & Olatunji, 2008; Wesp & Montgomery, 1998) have recommended that psychology courses offer opportunities for helping students develop these skills by questioning common myths about psychology. For example, Wesp and Montgomery (1998) were able to demonstrate an increase in critical thinking after taking a course designed to decrease beliefs about paranormal activities. Similarly, Lilienfeld and colleagues (2008) designed a course to help students to think critically about psychotherapy effectiveness; in other words, whether the treatment helps more than doing nothing or whether the outcome is due to the placebo effect. They were able to demonstrate improvement in the critical thinking skills of the students enrolled in the course.

In addition to research studies supporting the use of teaching critical thinking as a primary objective of psychology courses, two key texts to aid in designing courses include *The Critical Thinking Companion for Introductory Psychology* (Halonon, 1995) and *Thinking Critically about Critical Thinking* (Halpern, 1996). Both are filled with ideas for hands-on exercises for engaging students in tasks which may help to support the development of critical thinking skills. More importantly, with the availability of these developing measures, psychology educators do not need to guess about the effectiveness of these exercises. Utilizing the techniques available from the scholarship of teaching and learning (SoTL) literature, scholars can measure and document the effectiveness of planned interventions to enhance critical thinking.

Recommendations

Despite the importance of teaching critical thinking and the attempts to measure this construct, the construct remains difficult to measure efficiently. Ku (2009) identified several key points to consider, including whether an objective multiple-choice format can be used to accurately measure critical thinking. Ku also indicated that it is difficult to measure higher levels of complex reasoning using a multiple-choice format. Although multiple choice testing is certainly an efficient method of measurement, it may be difficult to convince researchers that a multiple-choice format provides an accurate and complete measure of critical thinking.

How do we balance the need for efficient measurement against the complexity of the construct? One solution is to adapt Halpern's (2013) general recommendations for measuring student learning in general. Specifically, measuring student learning should include the following elements (adapted for critical thinking):

1. Multiple, varied measures for critical thinking are necessary because no single measure can capture its complexity.
2. Faculty involvement in all aspects of the measurement of critical thinking and the utilization of critical thinking outcomes is essential for success.
3. Departments should be rewarded for conducting meaningful assessments of critical thinking skills, even when the outcomes of that assessment demonstrate room for improvement.
4. Faculty members and institutions should use the outcomes of critical thinking assessments to improve their teaching and their students' learning, whether that involves curriculum changes, individual faculty changing pedagogical approaches if needed, and so on.
5. Departments should take a value-added approach to the measurement of critical thinking scores over time; that is, strive to understand the critical thinking growth within each student rather than a comparison of different groups of students. Using this approach, all students can demonstrate enhanced critical thinking skills over time.
6. Seek to utilize multiple sources of information about critical thinking from differing perspectives; by identifying overlapping efforts, a convergence of efforts through purposeful coordination may lead to richer sources of data as well as more complete and representative outcomes.

Although an educator might have some indication about the critical thinking skills that are developed during a course, a more thorough understanding is needed. For instance, there are pre-course to post-course studies where researchers examined whether critical thinking changed measurably over the semester, with mixed results (e.g., Stark, 2012). However, we believe that more research is needed regarding critical thinking skills at commencement, and how those skills relate to success after the bachelor's degree. In fact, using the *Halpern Critical Thinking Assessment* (Butler 2012; Butler, et al., 2012), researchers have reported promising outcomes relating critical thinking measures to real-world outcomes.

Perhaps the most integrative measures of critical thinking are reported in the assessment plan of James Madison University (Apple, Serdikoff, Reis-Bergan, & Barron, 2008). Multiple assessments of critical thinking occur not only across courses but also at the conclusion of the psychology major's undergraduate career. Psychology departments should employ the available critical thinking measures more often, and coordinated research efforts on a national scope are needed to maximize the utility of such measures in institution-specific domains. The model provided by Apple and colleagues (2008) is a very good starting point for many departments to consider.

A fully implemented multi-modal multi-method approach includes embedded assessment, nationally standardized tests, cross-sectional and longitudinal studies, and the creation of a national database of test results that may be useful for program review purposes as well as the identification of best practices.

Without information about learning, there is less learning. Faculty cultures and incentive regimes that systematically devalue teaching in favor of research are allowed to persist because there is no basis for fixing them and no irrefutable evidence of how much students are being shortchanged. (Carey, 2010, p. A72)

In our opinion, an important component of assessment is using the information to inform and revise educational practice. The ultimate goal of testing is the prediction of non-test behavior. The ultimate goal of an undergraduate education in psychology is to impact behaviors, attitudes, and opinions of our students following graduation so that they can create real change in the world, whether that be through their own behavior or through the influence of others. The ability to think critically is a key skill in reaching these goals.

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References marked with an asterisk indicate a scale.

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Appendix: A Compendium of General Critical Thinking Measures, with Brief Descriptions

Measure	Brief Description
California Critical Thinking Skills Tests	Based on information provided, tasks with increasing difficulty are presented. Separate scale scores available for analysis, interpretation, evaluation, explanation, deductive reasoning, inductive reasoning and a total critical thinking skills score.
Cambridge Thinking Skills Assessment	Presents 50 multiple choice questions measuring critical thinking and problem solving skills, including numerical and spatial reasoning, critical thinking, understanding arguments and everyday reasoning. Available online and paper and pencil forms.
Collegiate Assessment of Academic Proficiency (CAAP) Critical Thinking Test	Four passages are presented followed by a 32-item multiple choice test which students clarify, analyze, evaluate, and extend arguments. Total score is generated.
Collegiate Learning Assessment (CLA) Critical Thinking, Analytic Reasoning, and Problem Solving	Performance and analytic writing tasks are presented that measure a student's ability to evaluate evidence, analyze and synthesize evidence, draw conclusions, and acknowledge alternative viewpoints.
Cornell Critical Thinking Test	Students are tested on deduction, credibility, and identification of assumptions; appropriate for grade 5 to grades 12-14.
Ennis-Weir Critical Thinking Essay Test	Testing involves getting the point, reasoning and assumptions, offering alternative possibilities and explanations. Used for grade 7 through college. Assesses problem solving, critical thinking, and communication.
Halpern Critical Thinking Assessment	Respondents are presented with 25 everyday scenarios, and free responses are constructed; then, the scenarios are presented again requiring a forced choice response. This procedure helps to separate generation and recognition processes.
iCritical Thinking	Presented with 14 tasks based on real-world situations, this instrument is completed in 60 minutes and yields a digital literacy certification specific to critical thinking in a technology-enabled digital environment.
International Critical Thinking Essay Test	Involves analysis of a writing prompt (identify the elements of reasoning) worth 80 possible points, and assessment of a writing prompt (using analysis and evaluation) worth 20 possible points.
Measure of Academic Proficiency and Progress (MAPP)	Addresses reading, writing, mathematics, and critical thinking. The critical thinking sub-score ranges from 100 to 130. Students respond to multiple choice questions requiring evaluation, relevance, and recognition. Student performance is classified as proficient, marginal, or not proficient.

Proficiency Profile	This multiple choice instrument equates to the former Academic Profile, and yields a critical thinking proficiency level (Level I, II, or III). Available in standard form (108 questions) or abbreviated form (36 questions).
Watson-Glaser Critical Thinking Appraisal	Students are assessed on decision-making skills and judgment; test takers classified as low, average, or high in critical thinking ability. Using Form S, 40 self-report items are used; higher scores indicate greater critical thinking abilities.
