Dental Education and Making A Commitment to the Teaching of Critical Thought

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Abstract

Less than two decades ago, Halpern (1998) presented a convincing approach for teaching critical thought. However, nowhere in her article did she explain how to "get" faculty to teach to thinking skills to transfer across domains of knowledge using: "(a) dispositional or attitudinal component, (b) instruction in and practice with critical thought, (c) structure –training activities, and (d) a metacognitive component used to direct and assess thinking." (p. 451) It is an open question as to what type of strategies will faculty need to demonstrate to create productive, knowledgeable, thinking citizenry? In this paper I focus on the faculty's role in promoting the teaching of critical thought, that is, critical thought processes, with particular reference to dental education. Many students can develop processes of critical thought with frequent practice involving the active use of multiple types of ill-structured problems and situations designed to require the ability (1) to recall useful information, (2) to use pattern recognition, (3) to discern pertinent information, (4) to think ahead, and (5) to anticipate outcomes and problems while (6) remaining composed enough so that their emotions do not hinder decision-making skills.

Keywords: cognitive science, critical thinking skills, dental education, instructional strategy, teaching

Introduction

As an important task of postsecondary education, teaching the process of critical thought in college has been studied in varied contexts with different participants. In this paper I focus on the faculty's role in promoting the teaching of critical thought, that is, critical thought processes, with particular reference to dental education. Many students can develop processes of critical thought with frequent practice involving the active use of multiple types of ill-structured problems and situations designed to require the ability (1) to recall useful information, (2) to use pattern recognition, (3) to discern pertinent information, (4) to think ahead, and (5) to anticipate outcomes and problems while (6) remaining composed enough so that their emotions do not hinder decision-making skills. I will discuss:

I. What is and why teach the process of critical thought,
II. Recent studies and critical thought,
III. Examples of instructional strategies,
IV. Challenges to studying the effectiveness of teaching critical thought,
V. Instructional strategies and the process of critical thought, and
VI. Recommendations for further research, followed by a
VII. Conclusion.

I. What is and Why Teach the Process of Critical Thought

Most educators agree that the developing the process of critical thought represents a pinnacle of sophisticated

thinking ability, an ability which schools aim to develop in today's learners. Future employers also place a high priority on seeking the ability to demonstrate critical thought processes among prospective workforce members (Burbach, Matkin, & Fritz, 2004; Halpern, 1998). However, the terms "critical thought" or "critical thought skills" are over-saturated phrases that often are not meaningfully described or utilized in consensually agreed ways in relationship to common instructional methods, nor are they carefully analyzed within the context of different forms of inquiry. As higher-order cognitive abilities, the processes of critical thought are important for individuals in making decisions relative to their careers, their personal and public lives, their financial well-being, and to everyday communication. As of yet, there is no single agreed upon instructional method to impart these skills, even though for students, the processes of critical thought can help them make subject matter knowledge more meaningful. During a time when individuals are required to make decisions more frequently than ever, the process of critical thought has become a widely endorsed learning outcome of college education (Halpern, 2001; Reinstein & Lander, 2008). Helping individuals to learn how to think at all levels of postsecondary and professional training is an important educational goal according to national reports such as the National Institute of Education's 1984 *Involvement in learning: Realizing the potential of American higher education.*

There is no absolute agreement on how the skills associated with critical thought are to be defined. Psychologists and philosophers tend to differ in their beliefs about how critical thought processes are acquired. One perspective holds that the acquisition of critical thought skills is a developmental process that is regulated by motivations, dispositions, and personality traits. Ornstein and Hunkins (2004) likened the development of the process of critical thought to the transition from Piaget's concrete operational stage to the formal operational stage. From this perspective, the stages of critical thought development are linked both to intellectual potential and to environmental experiences. So, for example, students who have not reached the formal operational stage may not have the ability to use critical thought because they are unable to handle abstract ideas (Behar-Horenstein, 2009). In other words, the development of the process of critical thought as a process may, to a large extent, rely on an individual's particular cognitive developmental stage.

Another rather more widely supported standpoint is that the process of critical thought can be taught and learned. For example, Sternberg (1990), Ennis (1989), and Lipman (1988) do not believe that critical thinking skills are a fixed entity or a form of intelligence that cannot be taught. This very belief lays the foundation of educators' ever increasing efforts to foster these processes among students. Indeed, Halpern (1998) defines critical thought in terms of cognitive skills or strategies that increase the probability that critical thinkers will have more desirable outcomes than noncritical thinkers. She asserts that individuals capable of critical thought have the ability to evaluate the goodness of their decision-making process and to process feedback as to how well they solved a problem. This type of metacognition, particularly among individuals who demonstrate critical thought processes, leads to improved thinking processes. Both Stanovich and Stanovich (2010) and Stanovich, West and Toplak (2012) offer a modern cognitive science perspective on the relationship between critical thought, intelligence, and rational thought. They point out the importance of recognizing the fallibility of one's own thinking, rather than weighing options according simply to personal preferences. Their perspective complements the definition of critical thinking put forward

by the American Philosophical Association's Delphi Project (Facione, 1990);

> *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. . . . 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 and the subject and the circumstances of inquiry permit.*

The work of these experts resulted in Peter and Noreen Facione's development of the California Critical Thinking Dispositions Inventory (CCTDI) and California Critical Thinking Skills Test (CCTST) (Facione, P. & Facione, N., 2013).

Admonishing instructors to teach "critical thinking skills" is an evaluative recommendation that implies students are not thinking well enough. In efforts to foster reflective, evaluative, and active open-minded thinking, Stanovich and Stanovich postulate that a superordinate goal of this effort is to try to foster *rationality*. They explain that "Individual differences in thinking dispositions including assessing variation in people's goal management, epistemic values and epistemic self-regulation – differences in the operation of the reflective mind. They are all psychological characteristics that underpin rational thought and action" (p. 209). Although their discussion is much more detailed than described here, they point out that intelligence in the sense of what IQ tests measure does not guarantee critical thought. Moreover, they make the case for why the rationality involved in critical thought should not be conflated with intelligence.

II. Recent Studies in Critical Thought and Dental Education

Efforts to incorporate the process of critical thought into college curriculum have been rising. Empirical studies have examined the effects of instructional interventions on the development of college students' processes of critical thought, and some studies show that certain interventions are effective (Erickson, 1999; Solon, 2001; Yang, Newby, & Bill, 2008; Yuan, Kunaviktikul, Klunklin, & Williams, 2008), while others demonstrate statistically non-significant results of similar or same interventions (Arburn & Bethel, 1999; Hesterberg, 2005; Sendag & Odabasi, 2009). Researchers question whether teaching the process of critical thought to college students is effective, which instructional interventions work with what population, under what conditions, and to what degree. Most recently in a meta-analysis of promising critical thinking strategies for teaching, who benefits, and what curriculum areas does critical thinking work best, Abrami et al., (2015) found that the use of teacher-posed questions in combination with authentic instruction and mentorship generated large effect sizes. This finding, while a starting point for thinking about specific instructional strategies that might promote critical thought processes must be considered contextually. First, results from meta-analytical studies rely on a specific and narrow subset of study results. Second, the researchers' classification system for coding instruction may need to be made more precise. Third, that some pedagogical interventions were associated with better performance on a CT test, which measures a narrow range of skills, suggests

that the observed effect sizes may not be fully representative of the type of teaching and interactions that are needed to promote critical thought processes.

From a practical perspective and with regard, in particular, to professional education, the need to teach students to develop and use the processes of critical thought has been a dominant theme for more than a decade. However, just how faculty are to teach these skills and just how students will demonstrate these skills in didactic basic science courses in the pre-doctoral dental learning environments is even less understood. Complicating this picture is that the outcomes/effects of teaching in higher educational settings has been only infrequently studied. Yet it is generally agreed that teaching students the process of critical thought has strong positive implications for patient care. As students increasingly take ownership of diagnosis and patient treatment planning and as they articulate the thinking that supports their decision-making, they are poised to become better dental health professionals..

With this type of training, dental health professionals are better positioned to teach patients about oral health diseases, about self-care, about what symptoms to look for, and about the role of compliance to promote dental health, in other words, how to become active self-caretakers. When patients take a primary role for self-care, rather than relying solely on healthcare professionals, they are likely to have fewer dental and other health care issues. Aside from helping faculty foster their students' ability to become competent practitioners, teaching students the process of critical thought has implications for the quality and costs of oral health care and patient wellbeing in general. In professional school settings, teaching students how to use these processes is essential to providing quality health care because it can (a) reduce errors and seriously negative events, (b) encourage cost savings, and (c) increase practitioner and patient satisfaction. Of course, it is essential to consider that, like most university faculty, most dental faculty rarely have been educated in teaching (Irby, DeMers, Scher, & Matthews, 1976).

III. Example Instructional Strategies

Pertinent research shows that on occasion dental hygiene faculty have effectively used instructional strategies to promote skills that support critical thought in their students (Moore, 2007). For example, Moore used a mnemonic to help lower students' initial cognitive load and to assist them in remembering how to follow a series of steps to new problem-solving settings. The mnemonic was INFORMED: I- Issues and Information known; N- Need to know; F- Find information; O- teach and learn from Others; R- Recycle, Reflect, identify Real problems; M- Make a list of solutions; E- Evaluate solutions; and D- Decide, Deliver, and Debrief. The results of this study suggest that faculty teaching these students were intentional in their efforts, and promoted students' recognition of structural aspects of problems and arguments so they could function as retrieval cues (Halpern, 1998).

Dental and nursing researchers report specific instructional strategies that promote critical thinking skills. In the dental education, Thamasitboon, Sukotjo Howell, and Karimbux (2007) found that there was a significant difference between students who took problem-based learning experiences and those who had traditional learning experiences as far as their development of several skill sets, including critical thought. In nursing, Popil (2011) reported the results of research on the use of case studies that provide real client situations in promoting critical thinking skills in educating nurses. Here I will describe Popil's strategies and, in the parenthetical phrases, highlight their connections to Halpern's suggestions for

deliberate practices that promote transfer of skills to novel contexts.. Popil's use of case studies required students:

(1) to use clinical information to identify problems, to recognize complicated issues (focus on structure and function of the problems and arguments so that underlying characteristics became salient),
(2) to parse descriptions of interrelated information (use of spaced practice),
(3) to highlight misinterpretations in their thinking, and lack of evidence for decision-making (asking thoughtful questions that require students to create the necessary connections that require recalling factual information).

Similarly, Staib (2003) found that role-play, case studies, group discussions, and student-instructor interactions were effective in developing the process of critical thought. This is an example of show how faculty can increase a student's transcontextual thinking skills and an awareness and ability to direct one's own thinking (Halpern, 1998).

Over the last decade, faculty development initiatives in dental education have brought about change in instructional practices. For example, work by myself and two colleagues (Behar-Horenstein et al., 2008; Behar-Horenstein et al., 2010) shows that engaging faculty in examining how they teach critical thought skills can lead to sustained change, change that occurs when the nature of their teaching was transformed from simply telling and showing to holding students responsible for explaining and demonstrating their understanding and thinking.

IV. Challenges to Studying the Effectiveness of Teaching for Critical Thought

There are significant challenges to studying the effect and the effectiveness of teaching processes for critical thought. One challenge is that the curriculum is highly is constrained. The need to cover a wide range of selected content typically seems antithetical to practicing the very skills and abilities that promote critical thought. In short, our educational systems do not encourage the process of critical thought as we might want them to. Another challenge arises because human beings are not naturally critical, and thus Tim van Gelder (2005) concurs with Hendricson et al. (2006) that the process of critical thought must be deliberately practiced with the intent to improve performance. Shermer (2002) agrees and describes human beings as "pattern-seeking story telling animals … [who] like things to make sense, and the kinds of sense we grasp most easily are simple familiar patterns or narratives" (p. 42), so the unfamiliar may be harder for us to grasp.

Furthermore, merely exposing students to good examples of critical thought is insufficient for developing it. Thus Deanna Kuhn (1999) suggests:

> The best approach … may be to work from both ends at once–from a bottom-up anchoring in the regular practice [of what is being taught] so that skills are exercised, strengthened and consolidated as well as from a top-down fostering of understanding and intellectual values that play a major role in whether these skills will be used (p. 24).

Kuhn's point has implications for teaching the process of critical thought in basic science courses. Even though students are heavily immersed in learning a tremendous amount of information, they still need to be presented with learning experiences that embed concepts in actual practice-based scenarios to increase the probability of transcontextual transfer (Halpern, 1998). Drawing from the work of cognitive scientists, it is clear that the teaching of content by itself is insufficient for teaching the skills that support critical thought across domains of knowledge.

Van Gelder (2005) suggests that students' process of critical thought improves faster when instruction is based upon argument mapping. When arguments are presented in diagrammatic form, students are more capable of following the processes that underscore critical thought. Because argument maps are visual and more transparent, they make the core operations of critical thought more straightforward. Van Gelder (2005) cautions, however, that belief preservation is human tendency. Thus, the process of critical thought may run counter to deeply-ingrained human tendencies. Individuals tend to seek evidence that supports their beliefs and to ignore evidence that goes against those beliefs. Ideally, critical thinkers recognize this confirmation bias and will put extra effort into searching for evidence that contradicts their own beliefs and will cultivate a willingness to change when evidence to the contrary begins to mount. Individuals capable of critical thought can decide whether or not to engage in the effortful process of generating alternatives and calculating probabilities when they realize that these skills increase the probability of achieving a desirable outcome. Naïve and flawed thinking is resistant to change because it makes sense to most people (Halpern, 1998).

Then there is the problem of how to operationalize the general definitions of critical thought (Ennis, 1989, 1993; Halpern, 1998; Lipman, 1993; Sternberg, 1990). Since thinking abilities are only meaningful and detectable when they are applied, the operationalization of the process of critical thought in instruction relies on the specific course context. In other words, the process of critical thought may differ according to such factors as field of study, student level, and instructional aims. The general definition of critical thought provides a framework and perhaps ideas for identifying specific learning objectives for the thinking skills in different courses, but may not identify how those objectives are best achieved.

Faced with this diversity, some have argued that the process of critical thought is a concept too complex to be limited to a narrowly defined construct (Flores, Matkin, Burbach, Quinn, & Harding, 2012), and so the usual practices of defining and operationalizing critical thought in higher education are discipline-specific. In contrast, in an effort to create common definition for critical thinking for test and syllabus design, Black (2012) suggested that critical thinking could be characterized as the process of " [1] analyzing arguments, [2] judging the relevance and significance of information, [3] evaluating claims, inferences, arguments and explanations, [4] constructing clear and coherent arguments; and [5] forming well-reasoned judgments and decisions" (p. 125). She provided a set of subskills that comprise these five domains, and thereby she specified a rubric of skills that can be used to assess student behavior relative to demonstrating the process for critical thought.

V. Instructional Strategies and the Process of Critical Thought

Researchers assert that how educators teach has a direct influence on what is learned (Nay, 1971). Thus, the instructional strategies selected must be appropriate to the outcomes that are sought. For example, strategies of inquiry are contingent upon the problem being investigated and the targeted concepts; it is essential that they be integrated with the associated processes of inquiry so that students can see how new knowledge evolves (Lipman, 1993). Of course, the mere act of acquiring information is not critical thinking. Thus, if it is a goal for students to develop the process of critical thought, then they must have opportunities to: a) engage in problem-based learning, b) analyze case-based scenarios, and c) engage in activities such as debates, role-playing, argument mapping, think aloud, and simulation exercises among others, and that these activities ought to constitute the majority of learning activities (Lipman). The benefit of

engaging students in these types of learning experiences is the *public* nature of exhibiting their thinking., They then have an opportunity to examine their tacitly held knowledge, to make their knowledge and thinking explicit, to respond to questions and comments, and thus to clarify their thinking processes (Flannelly & Inouye, 1998; see videos available at within the Critical Thinking Skills tab at: http://facdev.dental.ufl.edu/).

Weerts (2005) suggests that working in groups might reduce students' stress when trying to answer difficult questions. In fact, she points out that working together may result in better answers than working alone. Many dental educators might eschew the notion of using groups; however, it is important to point out that even in classes of 80-100 dental students, groups of six to eight students could be developed to facilitate learning and inquiry. The success of this approach has been demonstrated by peer led team teaching with large chemistry sections (see the Center for PLTL at https://sites.google.com/site/quickpltl/). Groups could be responsible for answering questions about chapter readings and then be randomly called upon during class time. Class time can then be used to present a case where the concept is illustrated, and students can work in small groups to analyze how that concept is operationalized rather than receiving discrete knowledge via lecture. Weerts also suggests that students' group work develops the process of critical thought by: 1) identifying issues, 2) gathering authoritative sources, 3) identifying potential treatments, 4) presenting competing points of view and 5) weighing modalities in light of the presenting case and 6) agreeing upon the treatment plan.

To ensure that students are developing appropriate skills the instructor and students can evaluate one another and provide each other feedback on the following criteria: (a) accuracy and relevancy of supporting evidence, (b) credibility of authoritative knowledge, (c) depth and breadth of thought and (d) clarity and soundness of responses.

VI. Making Explicit Teaching the Process of Critical Thought

Clearly, teaching the process of critical thought is a rational and intentional act. Instructors must have clear understanding of what process of critical thought is and what strategies are best employed. Thus, developing a repertoire of well-honed instructional activities that are appropriate to your specific discipline is advisable. Having an explicit conversation with students about what the process of critical thought is, what it looks like, and how you will model it, may help students differentiate the teaching of the process of critical thought from other learning modalities that emphasize lower level cognitive learning as exemplified by tasks that only require understanding and knowing information.

Effective teaching of critical thought would be characterized ideally by collegial and collaborative processes, not ambiguous forms of instruction wherein the learner does not know what to expect next or lacks a clear understanding of what type of behavioral or skill changes they should demonstrate. Teaching explicitly helps ensure less re-teaching will be needed because both teachers and students know their responsibilities.

Helping students develop the process of critical thought requires modeling, repetition, practice, and attentiveness to student readiness. According to Paul and Elder (1997) individuals progress through predictable stages of unreflective, challenged, beginning, practicing, advanced, and master thinking. Unless educators actually help students to develop an intellectual vocabulary for talking about thinking and challenge students to identify the problems in their thinking, their cognitive processes will remain invisible. The implications for curriculum development are that if instructors want students to develop the process of critical thought then they have to integrate it into instruction at the foundational

level. Not all students move at the same rate as they develop such skills. Thus, the instructional methods and objectives need to match students' cognitive and experiential abilities while trying to stretch them to their present growing edge.

With frequent practice, the active use of multiple types of ill-structured problems and situations designed to require the ability to recall useful knowledge quickly, use pattern recognition, discern pertinent information, think ahead, and anticipate outcomes and problems while remaining composed enough so that emotions do not hinder decision-making skills, many students can develop processes of critical thought.

VII. Recommendations for Research

As faculty educators seek to make teaching the process of critical thought the gold standard and the aim of dental and higher education, it is important to assess their investment of time and effort, to consider the purpose of assessment, and pay more attention to discipline specific instruction design. The purposes of assessment can range from student use of the processes of critical thought to making appropriate diagnosis, to conducting research or assessing accountability. For example, asking students to take critical thinking skills test inventories allows researchers to diagnose students' current levels of critical thought (Ennis, 1993), to make decisions about specific instructional focus and to share scores with students so that they become aware of their overall process of critical thought strengths and weaknesses (Ennis). The scores that result from an administration of a critical thinking skills inventory midway through students' program and/or at the program completion can inform professors about the effectiveness of their efforts to teach students the process of critical thought (Ennis). When these scores are available researchers can explore how instructional practices and design of the curriculum influenced outcomes.

The quality of teaching across the institution can only be as good as the instructional repertoire of the faculty. It cannot be assumed that all dental and/or other professional school faculty have critical thinking skills themselves. Consequently, assessing the faculty's process of critical thought and offering faculty development opportunities to enhance their expertise to teach students the process of critical thought may be crucial. Assessing our own thinking according to conventional standards provides baseline information and direction to guide development. Making an administrative commitment to assessing and studying faculty's global processes of critical thought and providing concrete opportunities for faculty to expand their teaching repertoire signals the preeminence of these skills.

Another related concern is the transferability of processes of critical thought and a belief that this process cannot be taught in isolation from subject matter. More importantly, Brown (1997) posits that students cannot progress in the development of their thinking unless they are given something to think about. Giving students specifics to think about is central to the development of the process of critical thought. Some of the instructional strategies to promote the development of the process of critical thought include paying attention to students' epistemological beliefs, promoting active learning, using a problem-based curriculum, and stimulating interactions among students in the study of real-life problems. Encouraging students to contribute their insights with other students and the instructor as well as having students formulate their ideas in written essay exams rather than in multiple choice exams so that their thinking becomes public rather than private is likely to have a significant influence on their development of critical thought processes.

Professors are encouraged to use strategies that build self-regulated learners.

Moving away from teacher-centered and discipline-focused instruction, professors need to encourage student dialogue, discovery, and curiosity. Curriculum designs directed by instructors' decisions about the way that allocated instructional time is utilized must give way to ensuring ample opportunities for students to analyze tasks, set appropriate goals, monitor and control their behavior during performance, make judgments regarding their progress and alter behavior based on these judgments (Pape & Smith, 2002). Professors need to develop a curriculum that moves towards an integrated contextualized delivery of content that embeds basic science as well as patient treatment planning and patient-centered communication. With enough problem-solving activities and opportunities to reason aloud, students can learn to emulate professors' process of critical thought, unlearn poor problem-solving skills, learn appropriate problem-solving skills, self-monitor, and learn how to diagnose and treat patients' oral health problems (Pape & Smith). To assist student development in the process of critical thought, faculty need to model the value of scientific discovery and life-long learning in their interactions with students, patients, and colleagues.

VII. Conclusion

Teaching students how to optimize the process of critical thought requires that they reflect upon their beliefs about how they teach and recognize that both students and faculty make decisions based upon their current frame of reference. Thus understanding an individual's attitude, ability and willingness to consider and weigh alternative points of view becomes an essential component of teaching students to develop and consciously employ processes of critical thought. Asking students to share their thinking aloud aids student understanding of their frames of reference and assists faculty in selecting strategies that can expand student processes for critical thought. We also know that even a moderate investment, can lead to enhanced reasoning skills. Given that the process of teaching and learning is highly individual, the same teaching method might differ in effectiveness due to different implementing protocol. Different treatment effects for different student groups indicate that who is learning matters. This means that when selecting strategies to engender critical thought, educators must take into consideration characteristics of the students rather than just fitting the same methods to students who vary in discipline, academic level, age, and other important aspects. Perhaps it will become necessary to tailor teaching methods for different students using personalized learning.

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